HOW WE SEE MATTER

Analysis of how materials could be treated after they are used

Author .....Javier Pajin Casajús

Tutor .....Josep Maria Fort Mir

University..... UPC-ESTAB

Course ..... MBDesign

Speciality.....Contemporary Design

Year 2018-2019

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Final Work of Master

ABSTRACT

Through an analysis of the current situation, actual classification of waste, the treatment of the used materials and the alternative movements occurring at the same time, a strategy to raise awareness as well as to create a process to treat products that are not treatable with the actual methods gets its shape.

The formalization of a machine, Títol Esgotat, supported by a designed system of treating receipts and transforming them into transportation trickets, proves that bringing the treatment of materials closer to the citizens, combined with a communication strategy, raises awaraness about the issues of the production-consumption system and about the waste treatment, giving the citizens a chance to start getting involved in changing it.

This project gives a viable alternative point of view on how material could be treated once the end of life of the product arrives, and aims to change the way users consume.
However, this is not enough if the way that the industry produce does not change.

RESUMEN

A través de un análisis de la situación actual, una clasificación real de los residuos, del tratamiento de los materiales usados y de movimientos alternativos que ocurren al mismo tiempo, una estrategia para concienciar, así como para crear un proceso para tratar productos que no se pueden tratar con los métodos actuales, toma forma.

La formalización de una máquina, Títol Esgotat, apoyado por un sistema diseñado para tratar tickets de la compra y transformarlos en billetes de metro, prueba que acercar el tratamiento de los materiales a los ciudadanos, combinado con una estrategia de comunicación, conciencia sobre los problemas del sistema de producción-consumo y sobre el tratamiento de los residuos, dando a los ciudadanos una oportunidad para involucrarse en el cambio.

Este proyecto da un punto de vista alternativo viable a cómo los materiales se pueden tratar una vez llega final del ciclo de vida del producto, y tiene como objetivo cambiar la forma en la que los usuarios consumen.

Sin embargo, esto no es suficiente si la manera de producir de la industria no cambia

RESUM

A través d'una anàlisi de la situació actual, una classificació real dels residus, del tractament dels materials usats i de moviments alternatius que ocorren al mateix temps, una estratègia per a conscienciar, així com per a crear un procés per a tractar productes que no es poden tractar amb els mètodes actuals, pren forma.

La formalització d'una màquina, Títol Esgotat, donat suport per un sistema dissenyat per a tractar tiquets de la compra i transformar-los en bitllets de metre, prova que acostar el tractament dels materials als ciutadans, combinat amb una estratègia de comunicació, consciència sobre els problemes del sistema de producció-consum i sobre el tractament dels residus, donant als ciutadans una oportunitat per a involucrar-se en el canvi.

Aquest projecte dóna un punt de vista alternatiu viable a com els materials es poden tractar una vegada arriba final del cicle de vida del producte, i té com a objectiu canviar la forma en la qual els usuaris consumeixen.

Tanmateix, això no és suficient si la manera de produir de la indústria no canvia.

KEYWORDS

Sustainability | Awareness | Production | Waste | Critique | Matter

"Design must be an innovative, highly creative, cross-disciplinary tool responsive to the needs of men. It must be more research-oriented, and we must stop defiling the earth itself with poorly-designed objects and structures. "

-Victor Papanek-

Design for a Better World, 1972

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1 | AN UNWANTED SITUATION

INTRODUCTION

In this project I will try to design a product that aims to understand how we see matter, analysing how we treat the materials nowadays and our production/consumption habits as a society.

Trying to have a critical thinking on how we process what we have and give a different perspective than the most common one to try to produce a product that will help rise conciousness and also solve a specific problem with a viable and simple solution, replicable in other scenarios.

RECYCLE WON'T SAVE US

Lately there has been an increasing tendency on messages about recycling by different channels (such as TV, Internet, Posters, Campaigns ...) to engage people to recycle more and separate correctly the waste for its processing. This phenomenon, caused by the fear of the climate change, global warming and other threats, is becoming intrinsic in our daily lives.

Recycling waste is a needed process to keep up balance between what we consume and what we produce, a balance in which we use part of the used material to produce new products or to re-do the same elements with a little less quality. Nowadays, with this praxis that we are continuously living with, we reached a point where this balance is not sustainable enough.

We produce useless or unrecyclable elements that are made with this recycled matter just for the sake of making things with recycled material. Having a "clean" image directed to the people or to the media has a priority, rather than thinking if the product itself is worth it, or which material is the most accurate to fulfil the needs of the use of the element, even than thinking about what is going to happen when the end of life of the product arrives.

SITUATION &OBJECTIVES

Having the previous context in mind, and aknowledging that we urge to have bigger changes if we want to progress in a more efficient and fructific way, I analysed what we actualy do whith materials and matter in an overall perspective.

Some issues appear when recycling is questioned. The most common waste-distribution to recycle is: Packaging, Paper & Cardboard and Glass Bottles and Packages; but some products with that material but with some different treatment or that had contact with food are not suitable for the most generic treatment systems because it alters the globality of the rest of the material. On those cases, either the materials are destroyed (mostly incinerated) or treated with a specific system that allows them to be reinserted with the rest of the recycled matter; this second case is only chosen when it's economically rentable, "as to be expected" ... .

Seeing the current situation, the objective of this project is to put in perspective the system we have, as well as creating an efficient method which demonstrates that changing the point of view of how we are treating the materials at the end of the lives of the products, even in the design and conception of the product, could produce an impact in our current established system.

Situation

PROBLEM

I noticed two main problems analysing the actual situation, both related between them and between our ways of doing things and managing resources.

In this part an analysis on a critical point of view will be conducted to highlight some of the issues that as a society, we try to justify.

RECYCLING SYSTEM

The actual recycling system allows, as the name itself means, re-introduce used material, treated first, in the cycle of production again to follow the same process and, with luck, if the final user recycles, end at the same point: returning to the cycle again.

This method is useful to maintain a balance between producing and consuming, but it's not possible nowadays because of the production and consuming situation we end up having.

On the other hand, it's not suistanable enough because the material is categorised in bulks and the materials that don't fit in any category due to some special treatment applied in the production process, contact with food during its use or in any other differenciation with the resto of the bulk aren't acceptable for recycling with the average methods, despite existing methods to treat that matter. That material is labeled as 'waste' and thrown away or burned because the specific treatment is not profitable enough as there are less products with this condition and it's not viable to treat them in the same place. In the actual situation, with the massive consumption and production those 'waste' materials are starting to grow more, and un-treated products are accumulating in landfills all around.

For those reasons I find the actual recycling system inneficient and focused on a production level that we have overcomed.

PRODUCTION / CONSUPTION

The real and intrinsic problem is the system of production - consumption we currently substain.

I observed that we produce and consume a lot of things, without preocupation just because we can and we want following the topics of 'tempus fugit' and the anthropocentrism inconsciently we live by ourselves without understanding anything about what surrounds us. We don't know anything. In the past humans have commited terrible errors without knowing it (smoking, massification of plastic usage, explotation of natural resources ...) but those errors helped us to advance in other ways.

The issue comes when we know that we are commiting something wrong or not justifiable enough and by innerce or predisposition we continue doing the same thing, that is what is happening with the production and consumption system, we produce useless things because people are buying them, and we buy them (me too) because they are being produced. It's a cycle, and if we don't change in any way this process, recycling will mean this, introducing the material to process it and transform it into useless things among other precious and useful products.

Nature's perfect package. Philip Brasor and Masako Tsubuku, 2016. 'In Japan, all other fruit bow to the top banana'. The Japan Times, March 26. [Consultation: 18 June 2019] Avaliable at: https://www.japantimes.co.jp/news/2016/03/26/business/japan-fruits-bow-top-banana/#.XQlbHbz7TGg

Maybe the solution is start to produce less things and changing the lifestyle of our society. If we want to be coherents with our objectives as civilization.
Perhaps we could find other solutions, but that's my point of view.

HYPOTHESIS

The main hypothesis of this project is that changing the perception regarding the waste and the materials and applying different treatments for nowadays-untreated materials will open a path to rethink the actual recycling process and the production-consumption system.

In addition, bringing the process of treating materials closer to the users as well as making it functional and viable will stimulate them to be more aware about how they and the industry are managing the waste problems.

METHODOLOGY

The process followed in this project starts with an observation and analysis of the current situation regarding the topic studied treatment of materials in this case.

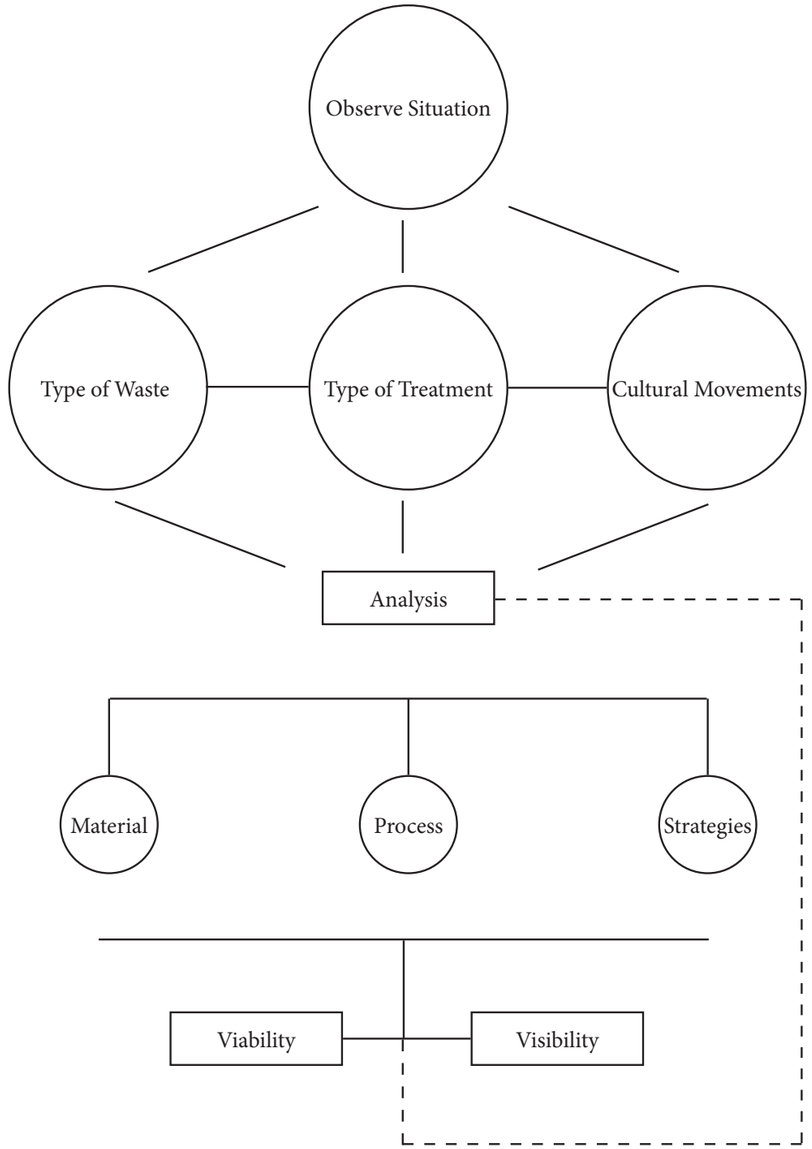
Inside the frame a research about what type of waste is classified nowadays, the type of treatment of that waste and the cultural movements that are related with the topic is made to extract insights.

Once the insights are studied, the materials of use as well as the process and the strategies to follow are designed. Having all the options on the table the propositions are sorted and chosen between all the presented options based on the coherence of the project and analysing which of them is the most fitting way to approach the problems.

When the strategy is chosen a study about the viability and the level of conscience will be run.

The conclusions of that last part could determinate whether is a good solution enough or if it isn't efficient enough, in both cases improvements would be indicated and if needed return to the analysis point to come up with other strategies.

[Scheme]



CONTEXT

The analysis is done in the context of the city of Barcelona.

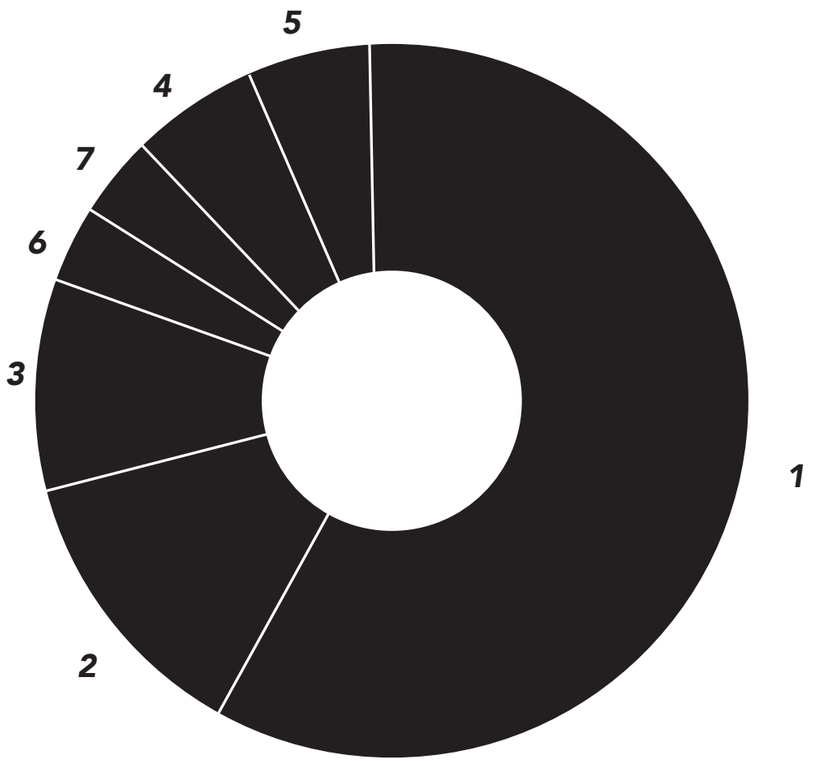
Barcelona is a city almost based on the diversity and the interaction of different cultures, but the citizens and the city itself have a clear and remarked identity.

Part of that identity is linked to solve the environmental issue in which Barcelona itself has an important role. For this reason, the city, the town hall and the Generalitat, have a huge politics for reducing the footprint, improving the pickups of the recycling dumpsters, the street service of cleaning, promoting public transportation or alternative ways for mobility and so on...

With these measures, I find it interesting to apply the analysis in this city, that already has a little bit of consciousness, and see how these criticisms and debate could be spread around the citizens in general.

Situation

WASTE COLLECTION



1_Resta: 64,5%
2_Organic: 14,5%
3_Paper: 6,1%
4_Vidre: 4,8
5_Packaging: 2,8%
6_Huge waste: 4,3%
7_Other types: 3%

The Generalitat has an annual control on how many waste per citizen is produced in each municiaplity as well as the type of waste. In that way a vision on the general waste could be used to analyse the situation in a more global scale, having numbers of most of the citizens.

[1]Generalitat de Catalunya. *Estadístiques de Residus Municipals* [online]. Recollida de Residus a Barcelona 2017, 2019. [Consultation: 12 April 2019] Avaliable at: http://estadistiques.arc.cat/ARC/#

2 | WASTE? NO, THANKS


NO MORE
WASTE
THANK
YOU

Waste?

TYPES OF WASTE TREATED

A starting point for the research could be to analyse the types of waste recollected in Barcelona, the context to know which type of materials are treated after the end of life of the products. With this information and a further inference with an investigation of the types of waste treatments, useful insights could be extracted to proceed with the project.

To look at the types of waste recollected the most logical thing is to look up for the container types and ways of collecting the town hall has nowadays. Fortunately, as this is an increasing topic the information is clear and accessible.

1. Dumpsters[1]

The dumpsters are the core of the collection of used material; each one is specialized in one category of elements. The distinctive element for each container is the colour. There are two types of distribution depending of the municipality, one with 5 types, that includes the packaging and other with only 4 types , that supress the packaging and adapt two of them. I will mention both but focus on the most common one, the one with 5 categories.

Five types: Green (Glass) – Blue (Paper) – Brown (Organics) – Yellow (Packaging) – Grey (Others)

Four types: Green (Glass) – Blue (Paper) – Brown (Organics) – Grey (Inorganics)

_Green (Glass packaging): On the green dumpster, the materials collected are glass packages and glass packages alone. The reason behind that is that the material collected in that way, is only used to create glass package. Any other pane parts or products need to be carried to the Civic Amenity Site. EcoVidrio a non-profit organization that is specialized in treating and managing of this kind of waste.

[1] *AMB* [online]. Medioambiente, 2019. Recollida [Consultation: 20 March 2019] Avaliable at: http://www.amb.cat/s/es/web/medi-ambient/residus/gestio/recollida.html

_Blue (Paper and Cardboard): The blue dumpster is where to deposit the paper and cardboard products. The products that are only made by paper, cardboard and/or ink. The rest of materials, paper with some adhesive layer, coating or contact with food or other material, should be deposited in other dumpsters, in the other waste usually. This approach is needed because those other components could have an impact on the actual paper recycling system as we know nowadays.

_Yellow (Light Packaging): in the yellow container, the light package has to be introduced. Either the ones made of plastic, aluminium, bricks. Ecoembes manage this category, an association that is in charge of collecting from the dumpsters and treating all the materials in the industry of the lightweight packaging. Other kinds of products with plastic, or aluminium mainly, have to be carried to the civic amenity site. This is the supressed category on the 4 phases systems because it is the one that the products are being consumed less due to the overproduction and over use of the package in all the industries, in that way if less package is being produced, less dumpsters are required.

_Brown (Organics): The organic material is the one (as the name says) that its composition is entirely organic and tends to deteriorate with the time. Usually this kind of waste is mainly food related products, leftover or plants. This kind of matter cannot be recycled, the treatment applied to those products is to compost and transform them into energy. A high percentage of the materials thrown in these dumpsters are not organic at all.

_Grey (Other): In the ‘other’ category goes all the products and waste that cannot be introduced in any other of the different dumpster neither carried to the Civic amenity site. A starting point for the research could be to analyse the types of waste recollected in Barcelona, the context to know which type of materials are treated after the end of life of the products. With this information and a further inference with an investigation of the types of waste treatments, useful insights could be extracted to proceed with the project.

2.Bins

In the street bins, the waste that could be thrown is the “pockets waste”. There are no more information about what happens with that kind of waste, only a couple of different advices on what to not throw there.

3.Civic amenity site

The last most important waste pick up method is the Civic Amenity Site there are some spots around the city where used materials could be carried to.

There they accept different products that are not available for throwing in the city dumpsters neither the bins nor any other service.

The issue is that most people do not even know their existence or are far from their homes, and people are not interested enough on going there. Even for the reason of not contaminate, one of the most important reasons following my criteria, people do not approach to those centres.

PREVENTION

Otherwise, before talking about treating the waste we should talk about how to prevent creating waste.

Preventing the waste should be the first strategy to treat it, making products with 0 waste or with less waste but with a strategy beyond the end of life of the product would be the wisest decision to make.

This would be the best way to face the treating of waste, not generating more waste.

On this project the concienciation about the prevention of generating waste will play a key role, being the driver topic of communication to the users and the public in general.

Michaella Pedros, Joining Bottles, 2016. From: http://joiningbottles.com/

This project treats the prevention of waste as a strategy of managing the material from one used product to give a functionality to that matter in another project.

The best strategy is not to produce unnecessari things, but nowadays our system of production can't change so drastically in a short period of time, so this strategies are the most factible right now. Neverless the system has to evolve and adapt and we should encourage that perspective.

DUMPSTERS

Waste?

Organic Waste

Photo by Tolga Ahmetler on Unsplash

Other Waste

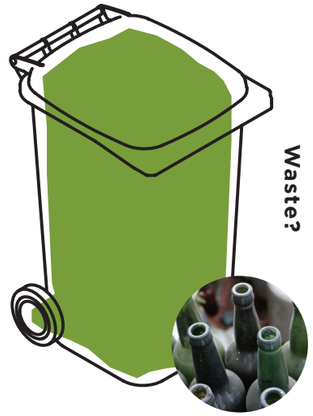
Photo by Nastya Kvokka on Unsplash

Paper & Cardboard

Photo by Jon Moore on Unsplash

Light Packaging

Photo by Simson Petrol on Unsplash



Glass Packaging

Photo by Bhavyesh Acharya on Unsplash

Waste?

TREATING MATERIALS

The starting point of the project is to investigate on which kind of ways of treating the materials once the end of life of the products arrives.

After researching on that I divided them in two groups following my criteria, and one of them is descarted to follow up further with the investigation.

Not doing anything at all or simply destroying the material is a waste of time in my perspective.

I will focus on the problems/needs/observations and this project will work around the second group: [1]

Recycle _ Reuse _ Specialiced Treatment

Waste?

TREATMENTS OF WASTE

Reuse

Def: to use something again. [2]

The reuse process is the one that is not mainly managed by the town hall or any institution, this process is possible thanks to the citizens, neighbourhoods or communities who decide to give a second life to entire used products or parts of them to repair the products or create other projects.

The treatment of those products are minimum and never on an industrial scale. The users themselves build up the entire production if needed and find support in the communities and in maker movement.

The optimum outcome in reusing or recycling is the Upcycling, a process where the used material gains value when is treated and transformed, rather for the strategy, for the product transformation or for the purpose of it.

Around Barcelona, some centres encourage this way of production and repairing; 'Ateneus the Fabricació', Fab Labs and The fixing centres of AMB are some examples about that.

[2] *AMB* [online].Medioambiente, 2019. Tractament [Consultation: 20 March 2019] Avaliable at: http://www.amb.cat/s/es/web/medi-ambient/residus/gestio/tractament.html

Recycling (Recover & transformation)

Def: the activity of treating materials or products using a special industrial process so that they can be used again.[3]

On the recycling process, the material is selected (on the current state of the process not all materials can be recycled). Then, separated and categorised by typology, as explained in the previous section, and transported to the process plant. Once they arrive, the bulk is prepared for the treatment to eliminate any possible intruder element that could contaminate the result, and finally treated in a specific way depending on the category of material.

[3] Reuse (verb). In Cambridge Academic Content Dictionary, 2019.

The finality of this process is to provide to the industry, recycled material to fuse in part with raw material and produce again the same products but consuming less raw material.

Following this line, I attach under this section the Compost process also.

The problem comes as exposed before when despite recycling, there is overproduction of products or if the products created with recycled material do not have any end of life strategy designed. In addition, the standards of production and consumption are strict; the market expects the same characteristics from a product made with only raw material than from one created with recycled material.

In some cases, that comparison is accurate, but both products have to be pondered in a different way because they have their own specifications and values.

The nearer selection sites are in Gava, Montcada I Reixac and Molins de Rei.

Landfill

Def: a place where waste is buried in the ground in large amounts. [4]

Some of the materials and products that are not suitable to be recycled and cannot be treated by any other way are taken to a landfill site.

There the parts are cleaned, sorted by category and materials, and introduced in a hole in the soil covered with clay or a special plastic layer

[4] Recycle (verb). In Cambridge Academic Content Dictionary, 2019.

where the possible impact it would do in the soil or the environment is reduced in some percentage.

The issue is that there are not much information about what happens or what will happen when the time passes and those products are still there.

"Landfills are not designed to break down trash, merely to bury it. That is because they contain minimal amounts of oxygen and moisture, which prevents trash from breaking down rapidly. So landfills are carefully filled, monitored and maintained while they are active and for up to 30 years after they are closed." [5]

[5] *Live Science* [online]. Planet Earth: Molika Ashford, 2010. What Happens Inside a Landfill? [Consultation: 24 March 2019] Avaliable at: https://www.livescience.com/32786-what-happens-inside-a-landfill.html

Burn (Energy conversion)

In some cases the materials that are not optimal for recycling but have flammable potential energy, instead of keeping the material in a landfill, igniting the materials with a combustion and burn them taking advantage of the energy is the option chosen to get rid of that waste. By this method, instead of not doing much with the material, it takes advantage of its destruction generating energy that substitutes other generated by methods with a higher environmental impact.

Despite this fact, some contaminants and/or toxic fumes or volatile components could emanate and spread away. Even with filters, the toxins stay in there.

The filters have to be cleaned or treated in anyway.
There are no information about whether or how this process is done.

Special Treatment

The last of the most common options is to treat some specific materials that could not be recycled by the average ways to be carried and treated in specific centres that are designated to do that specific process.

This process is the less chosen because it needs an specific infrastructure to treat only one type of waste and in much cases the outcome does not match the expectations, sometimes is neither profitable environmentally nor economically due to the lack of resources in the tools of picking up the materials and transport them to the sites.

The users and the industry does not help either because there a lack of consciousness or information already in the other methods regarding what to recycle, what to reuse or what to do with the used products in general.

Some examples of special treated materials are: Dirty diapers, Disposable cups, Pallets or Plastic Bags (these ones sometimes collected in the packaging container as well). [6]

Photo by Claudio Schwarz | @purzlbaum on Unsplash

[6] *The Balance* [online]. Paper and plastic: Rick Leblanc, 2018. Knowaste Recycles Absorbent Hygiene Products [Consultation: 02 April 2019] Avaliable at:https://www.thebalancesmb.com/knowaste-recycles-absorbent-hygiene-products-2877867

WHAT IS BEING DONE

On this part movements and philosophies linked with the concept of using used materials as a projectual element as the base would be analysed to extract insights for the framming of the project.

Maker

Def: someone who creates or invents things, either using traditional crafts or technology. [7]

[7] Maker (noun). In Cambridge Academic Content Dictionary, 2019.

Nowadays, the maker culture is increasing due to the popularization of the digital fabrication. This movement aims to make projects, mostly collaborative, without the industrial process behind and to facilitate the replication or the knowledge extracted from that process for all the public of any demography.

There is a general classification about makers. [8]

0 to maker: 0 to maker is to design and produce a product from scratch. This is the way to control more aspects and parameters since the design starts from a raw idea, still to be developed.

Maker to maker: In maker to maker, the makers collaborate with each other to complement their skills and take advantage of projects and procedures from other makers, as a basis for innovation. From here come the collaboration spaces as well as the online platforms and other media that allow the makers to be in contact and collaborate in all possible areas.

Maker to market: In maker to market the projects that arise from the workshops and communities, or from individual makers, are likely to bring value to the industry.
There are few makers who think about the commercialization of their creations being left out of possible developments by the industry, but increasingly the makers are aware of the advantages that can bring open the project to markets.

[8] Alicia Lewis. "The Segmentation of Modern Makers". *The Maker Files* [blog]. Agust 08, 2017, Ata [Consultation: 30 March 2019] Avaliable at: https://blog.anthonythomas.com/the-segmentation-of-modern-makers

Maker to advocate: A part of the makers as well as being participants in this culture and philosophy watch over to help, protect and improve this movement that has resulted in culture.
These makers act as a kind of movement lawyers, taking into consideration the most social, ethical and vision aspects.

This movement is relevant for the project because they usually create the projects with elements or materials sometimes considered waste. The whole structure is heavily linked with the reuse philosophy.

For me a maker is someone who creates projects with the resources available to them, covering needs and contributing value to society. These projects, accessible to everyone (Open Source), are functional from start to finish.

Cradle to Cradle

The Cradle-to-Cradle is a strategy that attempts to extrapolate the regenerative characteristic of the natural cycle and adapts it to the life cycle of the products[9]. In nature the waste is reused when an element becomes 'waste' the nature itself breaks it down into nutrients reabsorbed by the natural system. Cradle to cradle aims to eliminate waste altogether.

[9] *About the Institution.* Cradle to Cradle Products Innovation Institute [online] 2019 [Consultation: 5 June 2019] Available at: https://www.c2ccertified.org/about

Instead of a linear process where we tend to reduce waste, cradle to cradle proposes a circular closed loop. On that loop all the elements could be reintroduced in the cycle once they are used; in that way, there is no waste at all. All is reused.

This system could seem utopic because there are some incompatibilities with our actual stablished system. In my opinion it is a good expectation and point of reference where to arrive, but many ways of doing have to change if we seek progress.

Waste?

PROJECTS FROM MOVEMENTS

Precious Plastics is one of the best known and reference projects currently, they have emerged as an open source project that brings local production to a physical and real level, taking into account many of the stages of use of a product and helping to raise awareness and make the user more involved in the process of transforming matter to use it in different ways

Precious Plastics

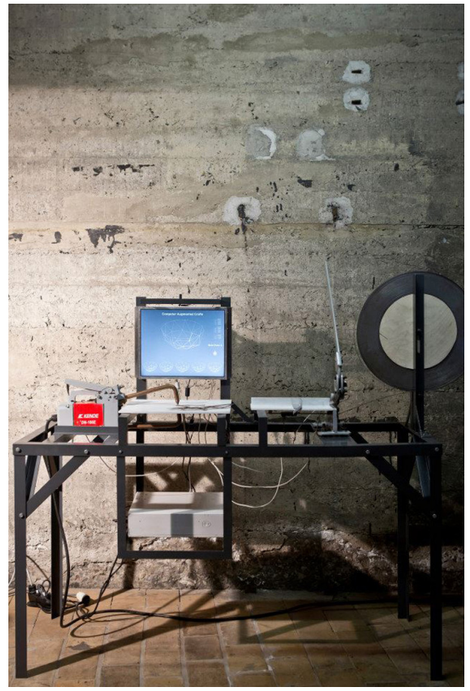
THINKK studio - Lanna Factory

Lanna factory is an easy method of making objects of typical embossing geometries but made with textile threads.

Uses a way of interaction with the user in which the user is basicalIy the engine of the machine so the machine is a maker product as part of shared values with the maker culture. It seems a good reference because it has an intuitive affordance and encourages the user to be a participant and to create.

The machine is a project that aims to combine digital manufacturing with craftsmanship helping craftsmen to make products by optimizing a mesh geometry, so that they can simulate that geometry while designing, can analyze the design before it is created and to make the artisan foresee possible failures or errors or at least minimize them.

The Machine - Computer Augmented Crafts by Christian Fiebig



STUDY CASES

PaperLab
Epson

Paper Lab is a new product of EPSON and a new technology also, only avalible in Japan for the moment. It's a machine that does all the recycling process of paper itself in the same place and almost without water (a very low quantity is needed). It's destinated to offices where the amount of paper used is big enough to implement this system.

Bottle
Recycling
Envirobank

Envirobank is a machine that collects used plastic bottles and analyses the trype of plastic and the distributor to manage in a better way the recycling process of those bottles and redistribute them in a more equitative way. During this process, the users get a discount in their next purchases.

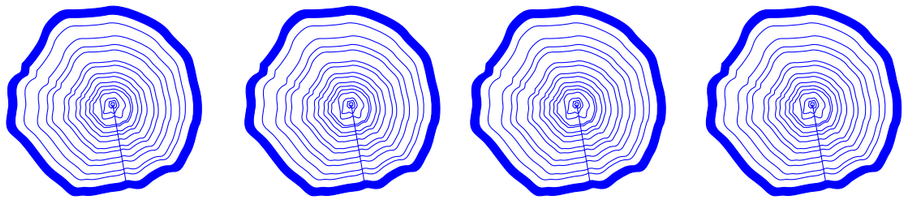
Tickets
Machine
TMB

The TMB tickets dispensors are the references for me in the ticket expedition topic. This machines accept different payment methods and sell different typologies of transportation cards in the same machine. They also have a characteristic shape and colors that allow the user to identify them clearly.

Waste?

Waste?

3 |RECEIPTS



1 person consumes equivalent to
4 trees per year in Spain

RECEIPTS

FACUA, the Spanish consumers' organization, says that replacing paper receipts with electronic versions is only permitted under Spanish law if customers accept it.

The organization, which says consumers are already asking for advice and information on the digitalization of receipts, notes that shoppers retain the legal right to a paper copy. It points out that many people in Spain do not have access to the internet, either for economic reasons or because they do not understand how so-called new technologies work.

Photo by Ivoiregion for tabscanner.com, 2019

RECEIPTS

[1]Receipt (noun). In Cambridge Academic Content Dictionary, 2019.

Def: A piece of paper that shows the price of something that you have bought and proves that you have paid for it.1

The receipts are made of paper with a coating that gives the property of thermal reactive. When heat is applied, the coating let see the other layer depending on how the heat is distributed. Taking advantage of this feature, the receipt printers uses that technique to write on that type of papers.

The receipt paper is regular cellulose fiber based paper with the special coating.The selling format are the rolls of thermal paper to insert them into a thermal printer.

The most common dimension of the thermal paper rolls for the commerce cash registers is 80x80 mm. Even though the majority of credit card terminals works with the 57mm wide rolls.[2]

Those two are universal also, so these will be the reference dimensions to work with.

[2] Panda Paperroll. *Thermal printer paper roll size* [online] Thermal Paper Knowledge, 2019 [Consultation: 1 June 2019] Available at: https://pandapaperroll.com/thermal-printer-paper-roll-size/

Photo by Javier Pajin, 2019

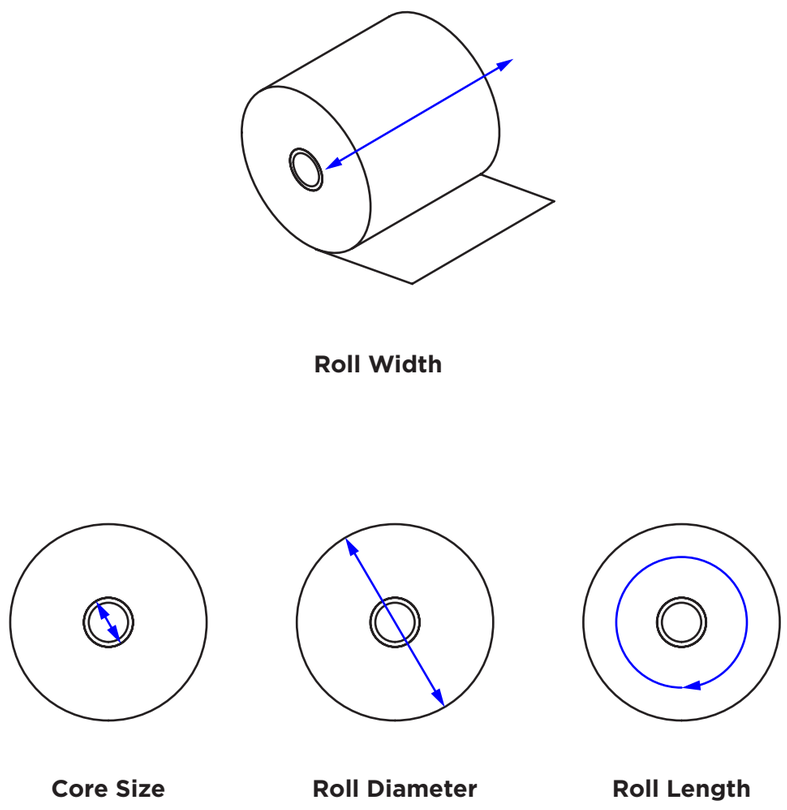


Illustration about the characterization of the thermal paper rolls parameters, Javier Pajin, 2019.

ADVANTATDGES

No ink

The lack of ink provides this method of obtaining a receipt a great advantadge, it reduces the part of the consumables and the ink process impact compared to other processes.

Cheap

Not needing consumables is part of its reduced price compared to other processes that are more complex. The components of the thermal printer are few so the maintenance is not so frequent.

Quality

The constant quality of the printing makes the process reliable, it provides consistent printing without preocupations on low level ink.

INCONVENIENCES /PROBLEMS

Non-recyclable

The problem about the recipts and the thermal paper is that it has to be recycled with a different methodology that is not efficient nor profitable.
And if the paper have a coating of any type it can't be recycled with the average paper recycling method.

Health

The most important issue is the BPA component, there are some studies that say that this component is toxic, but an **EFSA** (European Food Safety Authority) study reveals that there is no risk with the average exposure of toxicity. Also it remarks the uncertainty of the exposition, so the conclusion is that further studies with comparison will give the actual toxicity or not in high expossure of the BPA.

Having that in mind there are other components capable of doing the same as the BPA but with less concerns, that could be applied to reduce the social conception of the receipts.

(CEF) 2015 - EFSA Journal

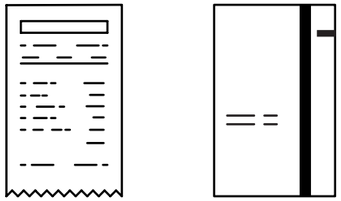
Receipts

DRAFT

The Draft of the process will be to transform the shopping receipts into transportation tickets. This process will be done by a machine in the moment, providing also some kind of information about the materials.

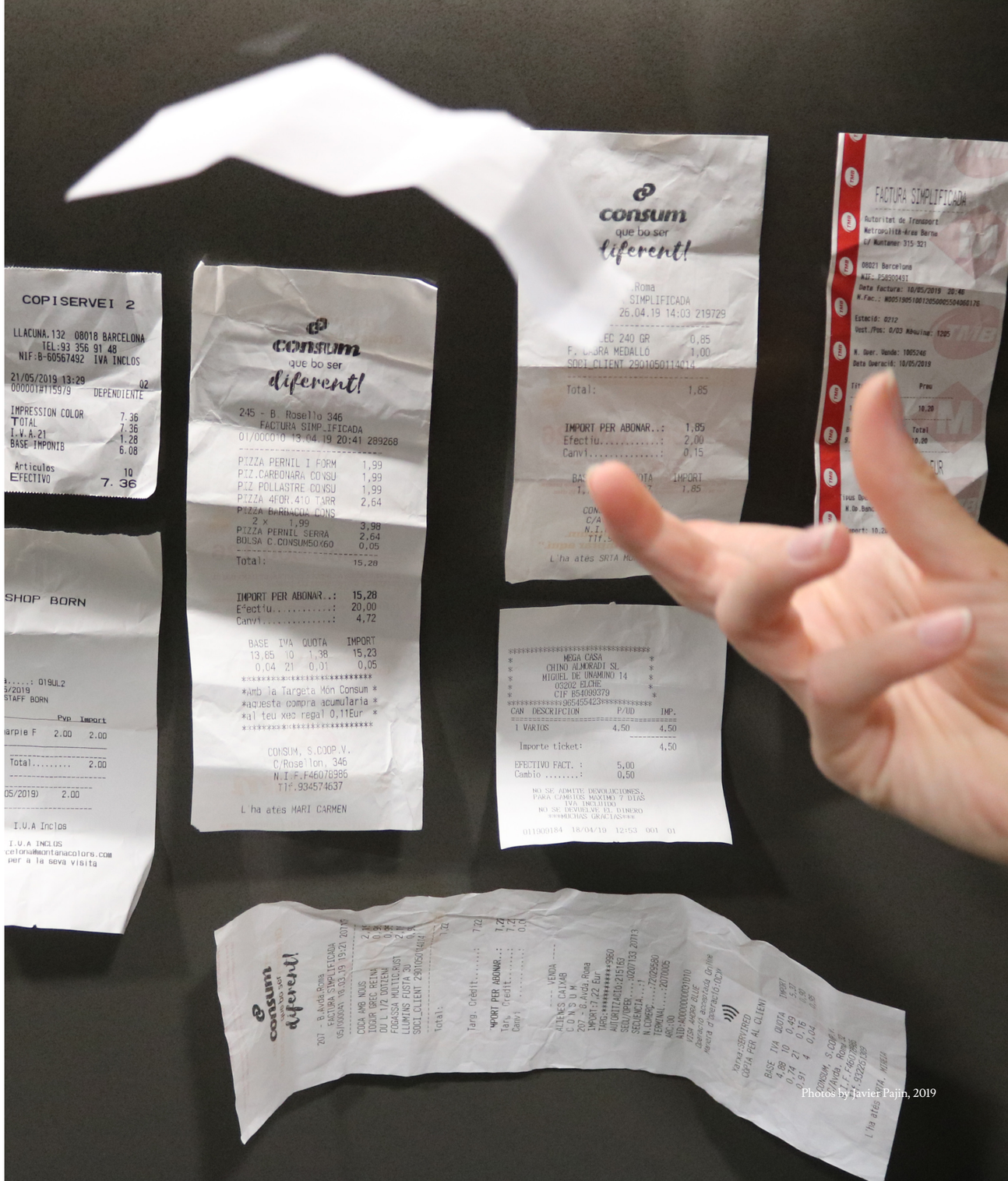
At the end of the life of the transportation ticket, it will be recycled into receipt paper also, creating a craddle to craddle circle.

From receipts to transport, paper to paper



1 transportation ticket = 5 receipts.

Photo by Roger Sànchez for Directa.cat



Photos by Javier Pajín, 2019

TRANSPORTATION TICKETS

In Barcelona there is a heavily diversity of public transportation that creates an intrinsic net in the city.

Buses drive around the city streets connecting almost any place, the subway moving big crowds in a short time between different neighbourhoods and the Tram and Funicular giving quick options between points in their rails.

As there are many options of transportation, there are many different transportation tickers available depending on what the needs of the users are.

The transportation cards of the TMB are made out of dense paper, almost cardboard, printed on one side with instructions and with a magnetic band on the other that has the information about how many payed travels are still on the card.

This is a product that most people throw in the paper dumpster without taking into account the magnetic band that has to be processed in other ways than the paper and cardboard are.
Having this information the project will link both materials to create a closed cycle between the transportation tickets and the shopping receipts.

How: The receipts will be inserted in the machine and treated to be transformed into a transportation ticked. With this process the materials does not need to be transported far away incorrectly added with the paper, it will be treated with a more specific purpose and finality.

This strategy will reduce the transport of the material and the waste of money, time, energy and resources to separate those typologies of products from the rest of them that could be treated together.

After the machine treated the receipt, the users could decide if they wanted to take the transportation ticket or just leave it there. If the user decides to take the ticket, a discount on the actual price of the transportation ticket will be applied and the price could be paid right away. In addition, if the user does not want the ticket another user without receipt could buy one there if there are left.

In Turkey or Medellín there are machines that recharge their transportation tickets if the users introduce water bottles on them. It is a bottle pick up systems to prevent the expansion of the bottles and the wrong distribution around the city or the wrong habit of throwing it to the trash.

On those countries this act is more relevant because their lack of drinkable water in every house.

Ankara Bottle Collection Machines by Gokhan Ergocun, 2019

A boy and his mother introducing a plastic water bottle in a vending machine to obtain their transportation ticke. 9 of November, 2018. Istanbul Undergraound by afp_tickers

SITUATION

Supermarket | Metro Station | Moving

The machine will be placed in supermarkets and in metro stations because they are the places of usage of both the material used and the material dispensed. Also, the context and the events on those spaces, such as waiting in line, standing, purchasing and passing by, allow the users to focus the attention on the machine and, in case it is the first time they see it, they will be as attracted as intrigued.

In the supermarkets, Títol Esgotat will be placed on the main entrance; frequently, the supermarkets have only one way in and one way out through the same door. When the clients leave the building, they will necessarily pass next to the machine, and the people who does not need or want the receipt they could introduce them into the system. In addition, most people have a supermarket near their home, so in their way to another place they could pass through the commerce and exchange their receipts, the same way they go to the bank.

In the subway station, the machine is placed before passing the barriers and on the platform, once passed the barriers. Those two spaces will let the user exchange their receipts to get the ticket right before entering the platform or they could make the change while waiting for the train, if they already have a ticket.

Also a group of machines could be moving, with the manual versions, around the city placing little instalations (and with help of a moving system) in key point of the city to rise awareness.

Photo by Enrico Perini from Pexels
Photo by Fancycrave.com from Pexels

USER UNIVERSE

The User Universe is a tool that helps to view the different categories of users (but not their actions) that interact in any phase of the life cycle of the product with the object or the infrastructure behind it.

Once the categories are defined, the next step is to link those groups depending on the relation with each other; if they have relation with another group, they are linked. In that way the analysis is not only focused on which groups interact with the product, also how the relations are between them but not the actions of the users.

This analysis provides a way of approaching the needs of the users in a more wide way treating more the needs related to the interaction with the product.

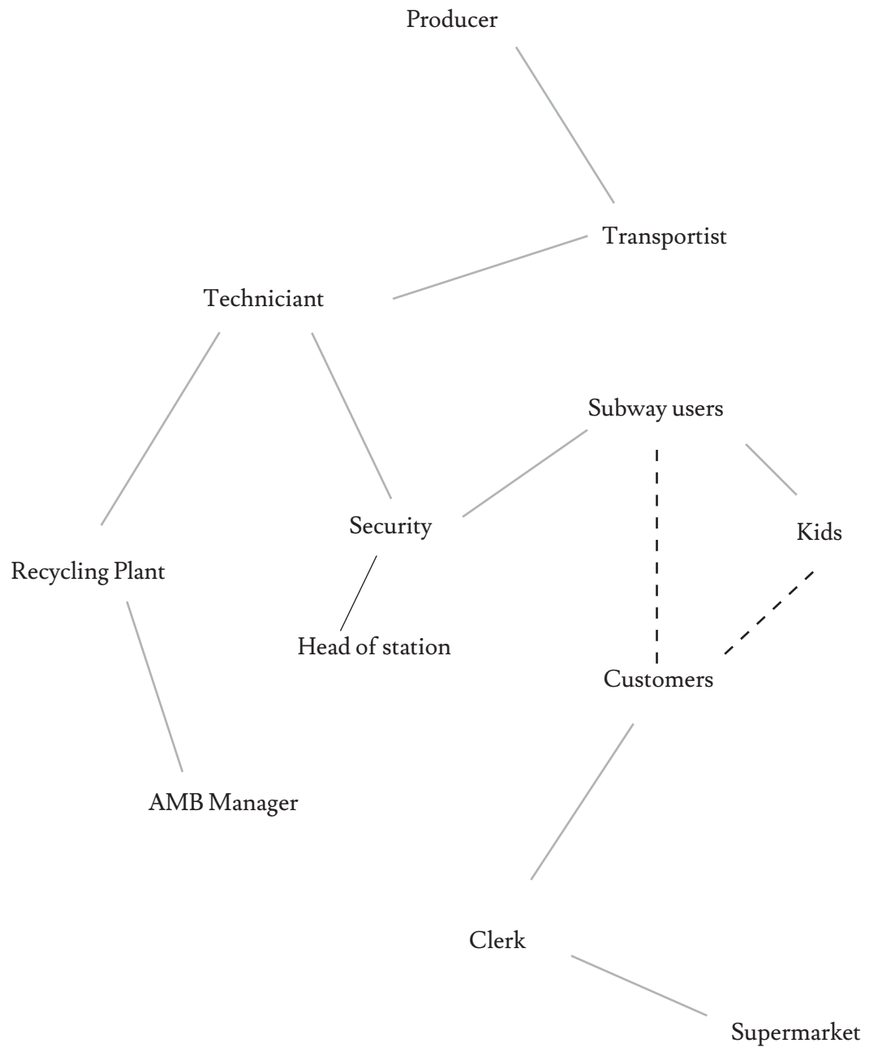
Usually the analysis has more profit when analysed a chain of at least three users.

Kids **Clerk** **Supermarket**

Customers **Technician** **Security**

Transportist **Subway users** **Recycling Plant**

Producer **AMB Manager**



Receipts

CHAIN FOCUS

The chain of users chosen is the one that links the subway users/customers of the supermarket with their kids, the clerk of the supermarket and with the manager.

Having the chain in mind, different aspects could be considered, such as the interaction for the customers and the kids, the accessibility for the clerk if it needs any refillable item, or the reparability regarding the manager.

This chain is similar to the one that joined also the security of the subway and the Head of the subway station, the considerations could be more or less equally applied.

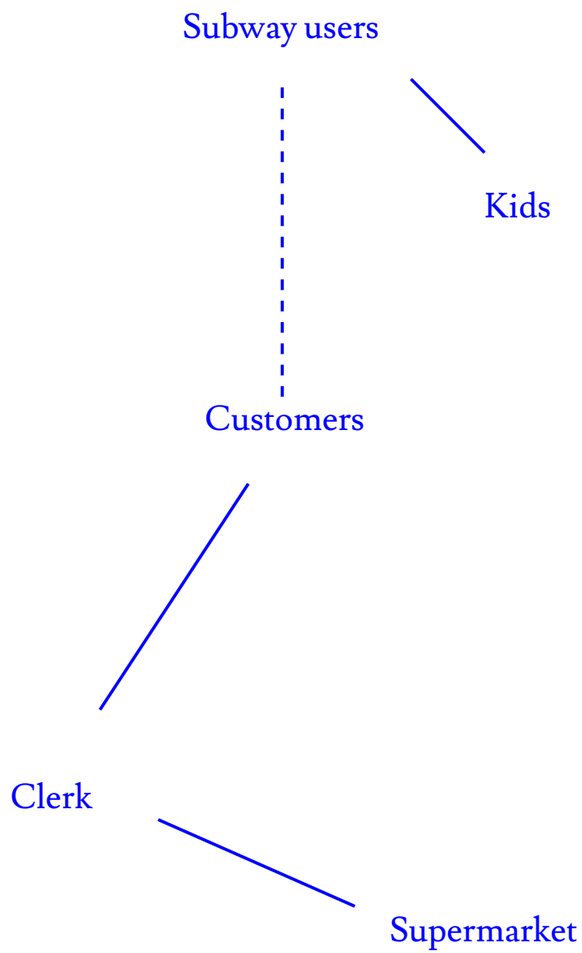
Having those aspects in mind while designing the process and the machine will help to the user interaction in at least 3 levels, but of course other aspects should be considered too, like the assembly or disassembly of the machine and the grade of user friendliness.

The interaction would have a lot of weight on the design, because it affects to the final user and to the kids also.

From the accessibility part and the assembly, the design should be easy dismountable and accessible, may be making the parts as much independent or dissociative as possible in that way the reparability would be improved also.

Once those considerations are exposed, the design should follow those lines as well as the project itself draws.

Kids —— Customers —— Clerk —— Supermarket



VALUE PROPOSITION

A system of machines to treat un-recyclable materials with the actual methods as well as rising conciousness and critical thinking among the users.

PROBLEM

The main problem is that the tretment of used products is only viable for specific materials due to the ways we are treating them and the lack of strategies of EoL (End of Life) of most of the products that are produced.

NABC

NEED

Find ways or strategies to reduce the waste on the EoL of the products and explore how to treat the ones that nowadays are not treated.

BENEFIT

If the mentality changes and the society becomes aware that the material is not the cause of waste but how we use it, a positive change on the production - consumption will occur.

APROACH

Take recycling to a more local level and change the vision of recycling the material to obtain that same material only.

'COMPETITOR'

Talking about a competitor would be a wrong terminology in my case. The similar products/ systems related to this project could be the picking-waste machines, like the ones that collect plastic bottles in exchange for different benefits.

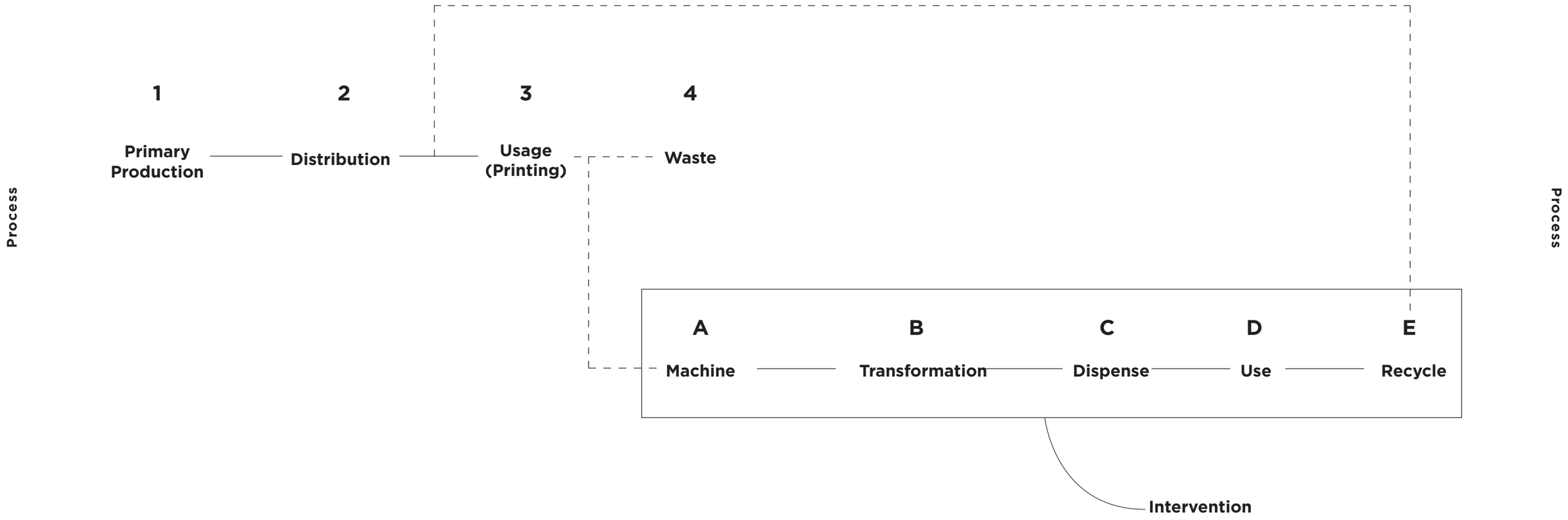
4 | PROCESS

90.5 % OF PLASTIC WASTE HAS NEVER BEEN RECYCLED.

Photo by Peter Clarkson on Unsplash

UN report by academics Roland Geyer, Jenna Jambeck and Kara Lavender, 2018.

PROCESS GRAPHIC



PROCESS LINE

Primary Production In the primary process, the paper for the tickets is made with the usual steps to follow to create paper rolls, with or without thermal coating, depending on the receipt type.

Distribution On this second step, the rolls are distributed to the destination, most commonly to companies, businesses and shops, mainly supermarkets.

Usage (Printing) Once the rolls arrive to the business, employees mount them into the cashier's machine to print whenever an item pass through the laser scanner.

Waste When the printing ends most of the times the customer do not even bother to take the paper or they take it and throw it away to the bin, because most of the receipt types are not compatible with the usual recycling system for the average paper.

Machine The option that I propose is, instead of throwing away the receipts, to give them a second life with an upcycling method, transforming them into transportation tickets with the help of a machine.

Transform Inside the machine, the receipts will be processed to become paper tickets. The process will fit the necessities of the manipulation of the paper and will finish with an actual functional transportation ticket.

Dispense After the transformation of the paper, the ticket is expedited through the machine to the user, who will have the opportunity to learn more about sustainability with the machine interface.

Use The life cycle for the transportation card will be the same as that of an actual ticket made out of cardboard; these tickets will not modify the scanner system.

Recycle Once the final life of the cycle of the transportation tickets arrives, the paper will be transformed into receipt rolls again with the actual methods of recycling. In that way the circular process comes to the starting point again and the cycle is closed.

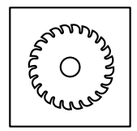
PROCESS SELECTION

Once the overall process of the receipt transformation, a more in-depth research on how this transformation itself could be possible allowed to pick and/or design some possibilities of systems that could fulfil the purpose of the machine.

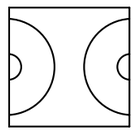
In the next subsection, an analysis of the features, steps, and needs of each system will be displayed and compared to select the one that fits in a better way with the objective and the interests of the project. Some comparison criteria will be:

Complexity: On which the difficulty of arranging the system will be considered.
Stability: To identify the process with better and more constant results.
Speculate: The concise and exact information regarding the needs of the system or the system itself, if it already exists, is available at the moment.
Space: This characteristic is the quantity of space the method applied to the machine would occupy.

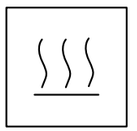
Also, to compare the needs of every method in a more graphic way, icons are created to represent each aspect:



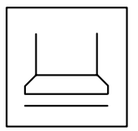
Shredder



Grind

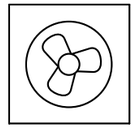


Vapour



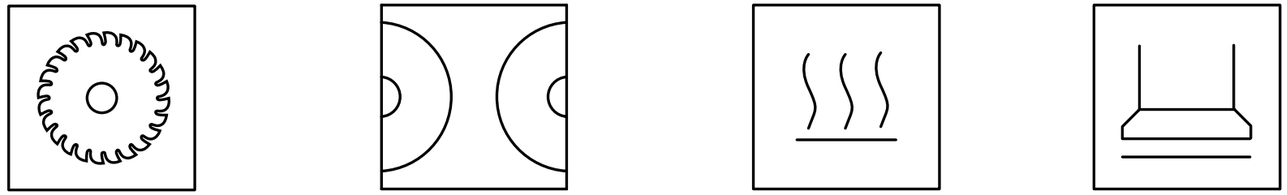
Press

Water



Dry

• 1 NO WATER & SHREDDING
(Dry Defibration)



COMPLEXITY ●●○○
STABILITY ●●●●
SPECULATE ●●●○
SPACE ●○○○

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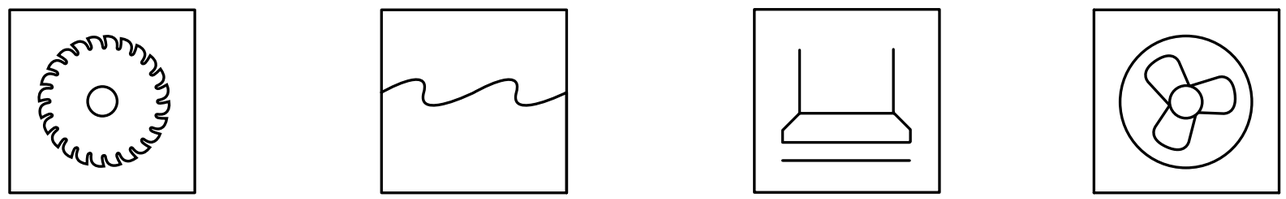
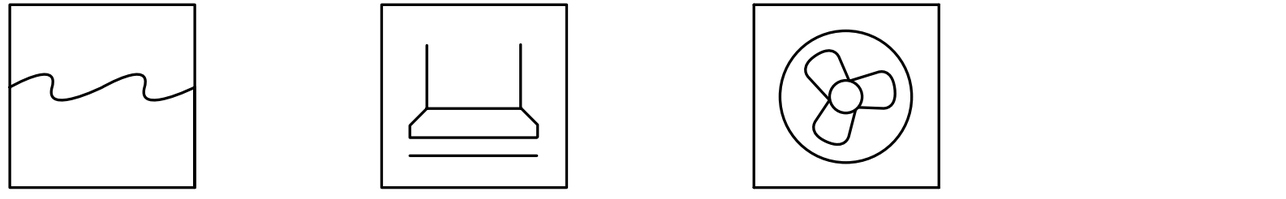
2 WATER SHREDDING
(Traditional recycling)



COMPLEXITY ●●●●
STABILITY ●●●○
SPECULATE ○○○○
SPACE ●●●●

---

3 WATER & NO SHREDDING
(Pressure system)



COMPLEXITY ●●○○
STABILITY ●○○○
SPECULATE ●○○○
SPACE ●●○○

Process

● Chosen one

1. NO WATER & SHREDDING

Chosen one

(Dry Defibration)

Components:

Interface

Tickets Entry

Defibrating Zone

Pulp Storage

Binding Zone

Pressure Stage

Dispenser

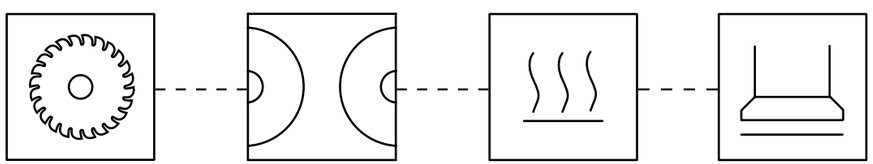
The inner process of the machine will consist of 5 main steps. The first process will be shredding the paper once the receipt is inserted. In this part, a filter acts to prevent air suspended components to spread away.

The second step is grinding/defibration which means reducing the paper pieces to its cellulose fibers.

Once the second process ends, the machine mix the fibers with a binder that does not require water to produce a so-called, dry binding process.

On the fourth phase, the mixture compressed by a press is reduced and compacted to the specified thickness that the subway doors accept.

To finish, before extracting the final transportation ticket, a cutting matrix cuts the sheet to the correct size.



2. WATER & SHREDDING

(Traditional)

Components:

Interface

Tickets Entry

Schredding

Pulp Storage

Soaking Zone

Pressure Stage

Drying Area

Dispenser

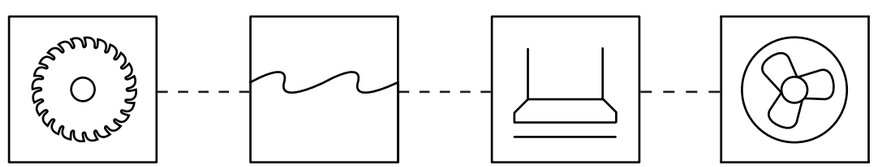
This process would consist of an adaptation of the traditional process of recycling paper in a small scale.

The first thing needed is to break down the paper into little pieces to break the fibers and expose them for a better mixture.

After that step, the paper pieces would be soacked in water to weaken the paper and creating a celullose paste.

Then the paste is pressed to the specified thickness and cut to make a sheet with the given dimentions and specifications.

The last step of the process consists of letting the sheet rest until the mixture is almost completetly dry.



3. WATER & NO SHREDDING

(Pressure system)

Components:

Interface

Tickets Entry

Flattening

Storage

Soaking Zone

Pressure Stage

Drying Area

Dispenser

The key of this process would be to use the receipts with their original shape, as sheets of paper.

The first thing to do would be to introduce the tickets into the machine.

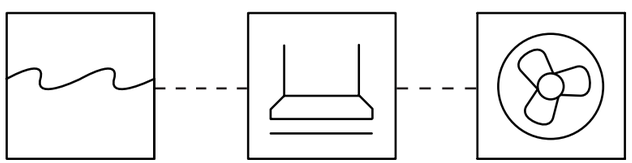
Once the tickets ener the machine are flattene and storaged for further processing.

When the number of tickets are enough they are put together layer by layer soaking them to maintain the union.

On the next step, the tickets joined by the emmulsion are compressed until the thickness is the specified.

At the end area, the group of layers are cut to the right shape.

Finally the transportation ticket is dispensed by the machine.



EXPERIMENTATION

To support the selected process, an experimentation part to try out the viability of this process will be conducted.

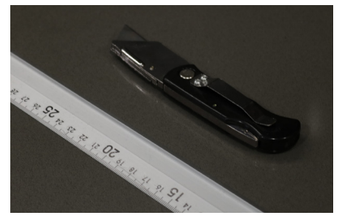
Thanks to the conclusions of this phase the designed path of the treatment of the receipts could be improved in the point of view of the user as well as from the process itself, optimize the steps is fundamental to accomplish a smooth functionality of the machine.

The following points are the material selected and the steps of the experimentation, an extrapolation of the industrial process done in a manual way and with everyday tools.

Materials:

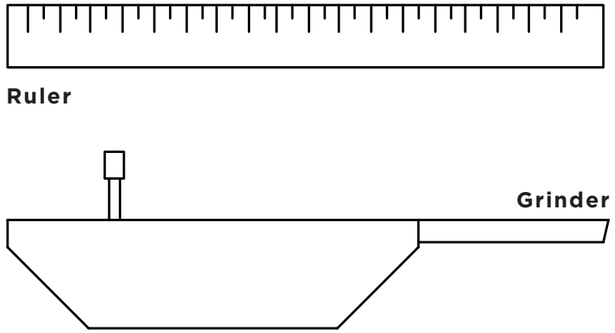
Paper Shredder

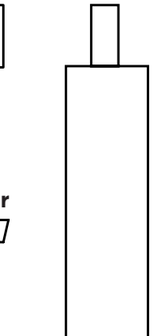
Grinder

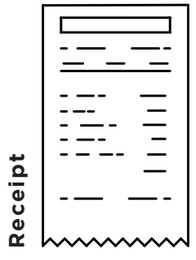


Ruler **Cutter**

Rolling Pin **Receipt**







1_Prepare the material

The first step is to get enough receipts together, unroll them and extract any external element added to them, such staples.

2_Shred the recipts

The next step consists of shred the receipts to make easier the grinding process on the next stages.

3_Group the pieces

Collect all the pieces to process them later on the next step.

4_Grind

Once the pieces are put together they are grinded with a mill to defibrate the pieces.

5_Group the fibers

Collect all the fibers to process them later on the next step.

6_Mix & Press

The fibres get mixed with the emulsion and pressed to make a layer with the wanted thickness

Process

7_Cut

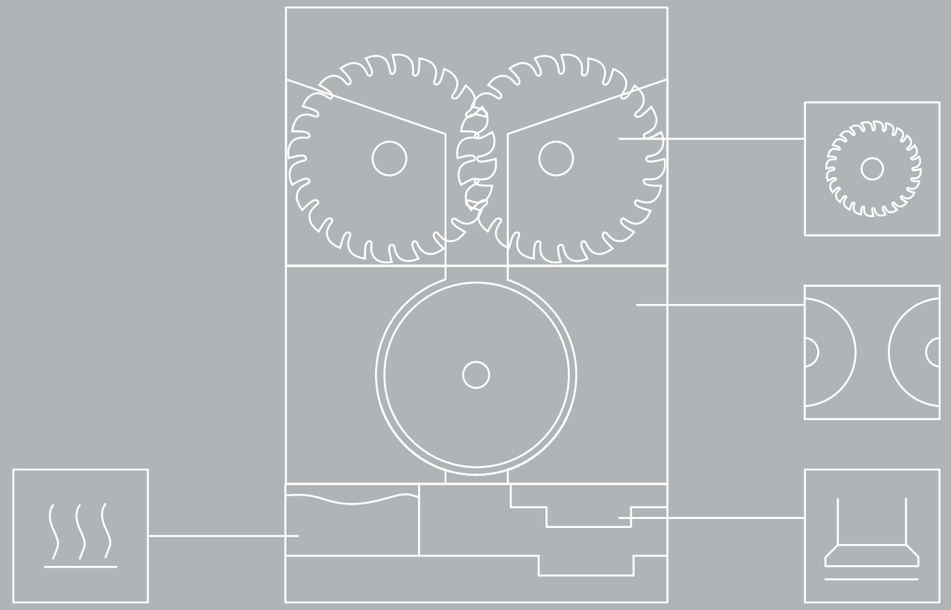
Once the layer dreid, with the help of a ruler and a cutting knife, the mixture is cuted to the specified dimensions.

8_Result

The card is ready to use.

Photos by Javier Pajin, 2019

5 | FORMALIZATION



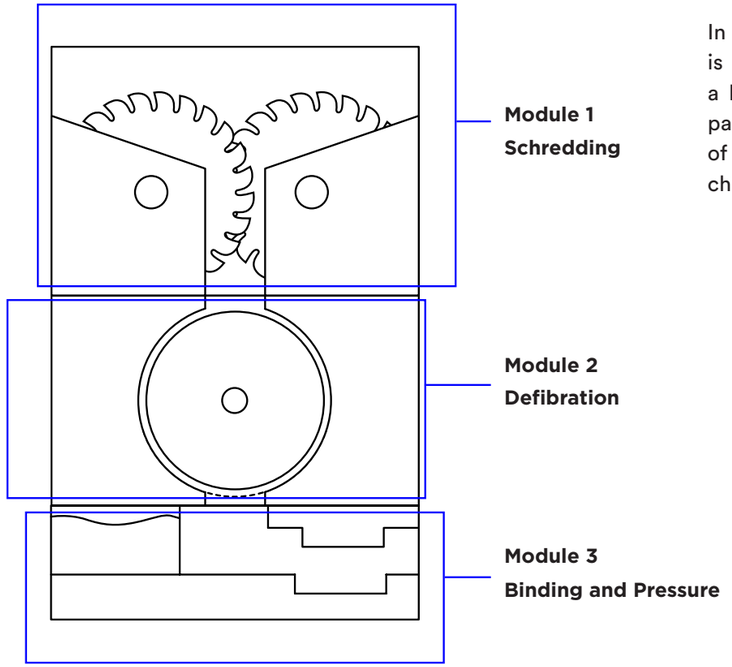
MACHINE INNER SYSTEM

The process will be designed in a vertical way to take profit of the gravity force that will make the method more efficient.

MODULES/BLOCKS

Following one of the strategies of Ecodesign and introducing an innovative aspect to the machine itself. The phases of the process will be designed to constitude different modules for each part. Those parts could be separated individually and extracted from the machine. With this feature, the machine would be fully versatile and each module could be replazable whenever it needs maintenance or brokes.

In that sense, the machine is more efficient and has a longer life cycle as each part could be fixed instead of changing the whole machine.



REPRESENTATION

The machine will be represented as a public service machine/installation distributed in some places of the city, mainly indoors for the users to interact with them and make the exchange.

Electric bus stop
TMB

This model of bus station could be found in Barcelona, and provides a tiny shadow spot, a seat to wait for the bus,
and information regarthin the transport.
The most characteristic feature is that its powered by solar energy..

ATM Machine
Wells Fargo

The ATM have been an iconic point since they appeared, accesible at any hour of the day and with multiple functions and facilities to allow the user make any operation they wanted without any external help but the instructions of the machine itslelf.

Parkimeter BCN

The Parkimeters are fully recognizable around the city, Those are elements that are part of the urban furniture but thye have an internal mechanism indeed. Although could be discussed its asthetics, for shure it has become a symbol of each city that has unique parkimeters.

Telephone Booth

The Telephone booth were signs of the city, here very popular and in other countries as London even icons of the city. They have a clear purpouse and they were fully recognizable. Nowadays, they lack of functionality but they are still a visual reference of the cities.

INTERACTION

The interaction is a key part of the process, a part where the usrer must feel confortable and confident when using the machine, if its too complex could be an obstacle.

Solar machine
Eames

The Do-nothing solar machine from the Eames is taken as a reference because of its multiple mechanisms. Those movable parts invite the user to analyse and try to understand the machine.

Spectacle's
Vending Machine

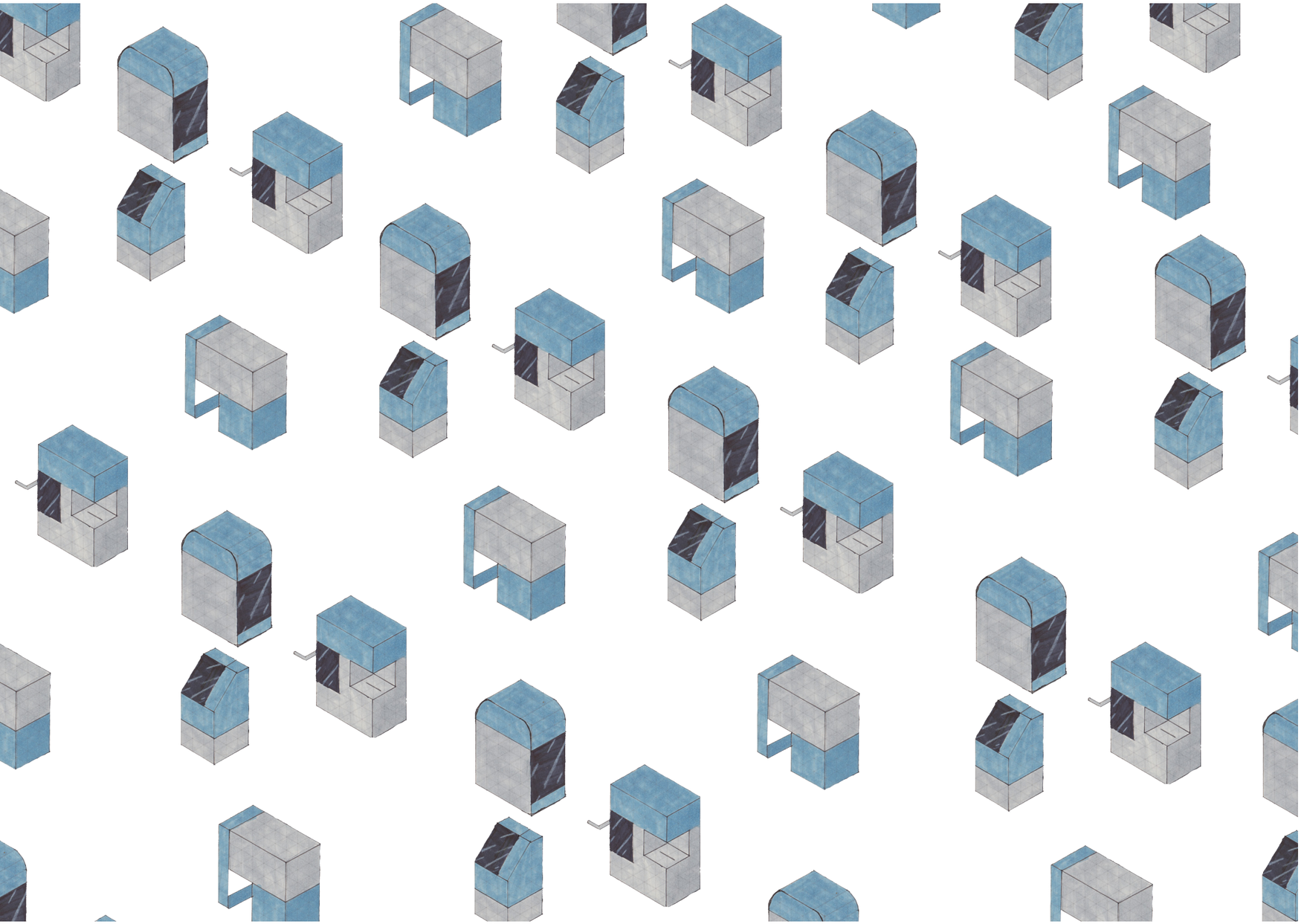
This machine from Snapchat company is a sellig point of their glasses (The spectacles), and allows the user to see themseves with the glasses with AR, and also buy the actual glasses.

Game
Machines

From the game and gambling machines a extraction about their atraction to the users and the way that the mechanisms interact with the players is intuitive and easy to learn, as well as fun.

The Price of Light
Lucas Muñoz

Project designed by Lucas Muñoz aims to show the real cost of light through a machine that uses salt ions to produce the electricity generated by an AA alkaline battery for 40 seconds. The interaction comes with the machine itself and the concienciation, understanding the concept.



SKETCH

On the sketch step the shapes and mechanisms of the referents analysed before were extrapolated and applied as inspiration in its own way to the machine.

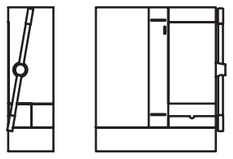
The shapes also were conditioned by the context of use, as it is designed to be in a public space, should suggest a sensation of durability and strength, as well as inviting the user to interact with it.

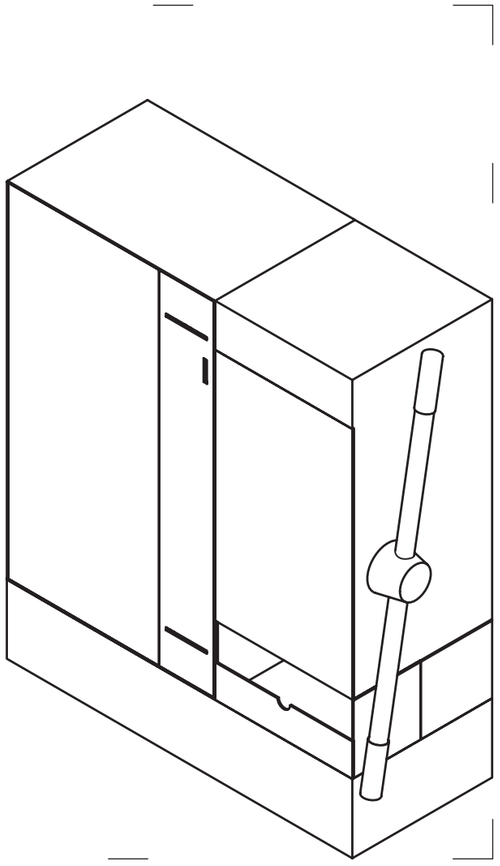
The materials, although not decided yet, played they part on the drawing and sketching process, thinking already on them and how the shapes could come alive to be auto-sustainable and with stability.

SHAPE OF THE MACHINE

The final shape of the machine driven by the vertical process and adding a component of display and a lever to support the interactive part and to enhance the user experience.

After analysing the referents related to the different aspects it has taken influences of the normalized vending machines fused with other interactive assets as well as a personal perspective regarding how to follow the topic.



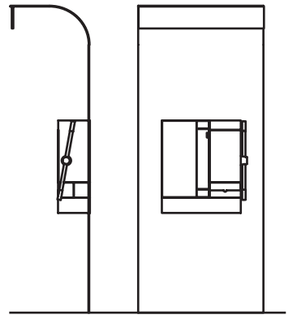


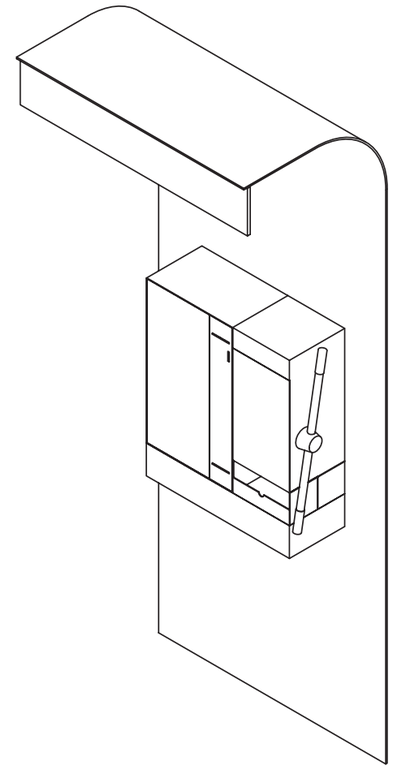
STRUCTURE

The supporting structure is added to make it a visual point of reference, to create a specific space in the context of application for the machine where the user know they could go to treat their receipts.

This concept and shape follows a simple path of a sheet that folds to make a sensation similar of the one on the telephone booth, that the user is embraced by the structure creating a space inside the space.

In addition, a signboard identifies the structure, relates it with the machine, and provides direct illumination in that zone. It is meant to be a visual signal as a whole, which the user could localize in an instant and see what is happening there.



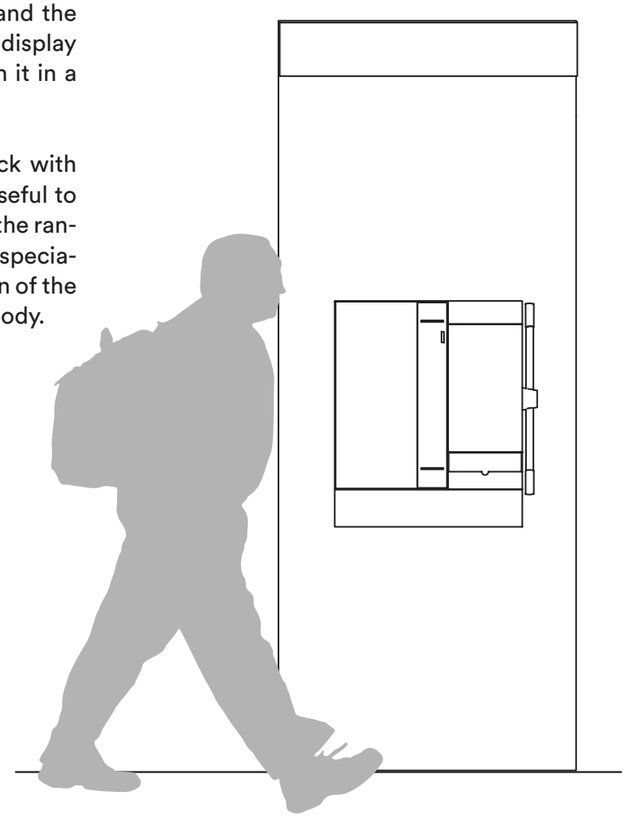


6 | TÍTOL ESGOTAT

PROPORTIONS & GENERAL DIMENSIONS

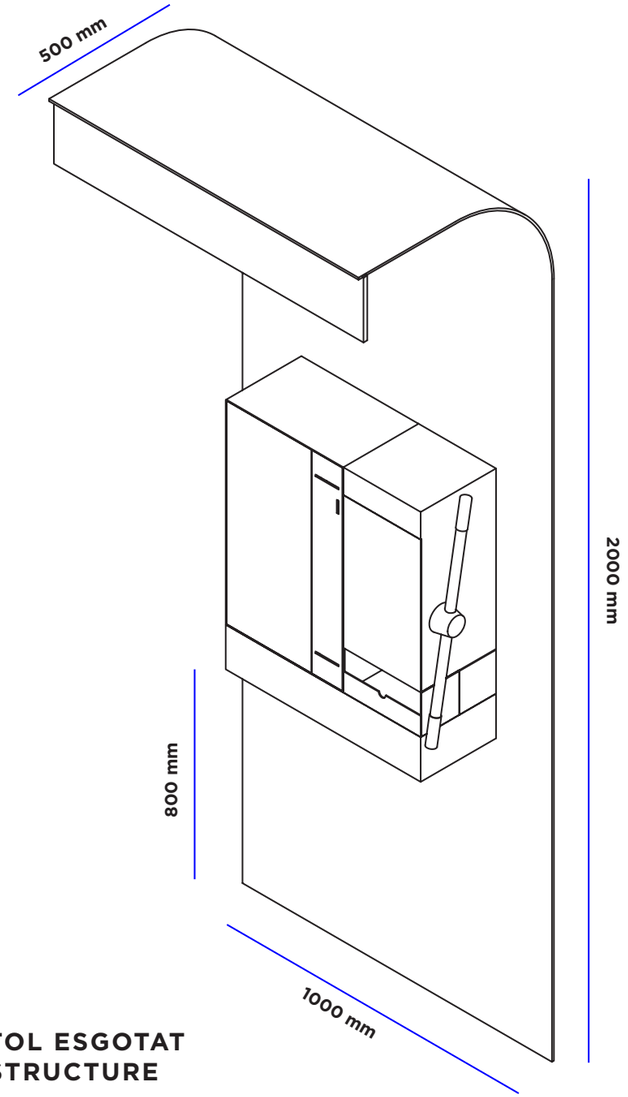
The proportions of the machines were determinate mainly by the mechanism and the lever as well as the screen; those 3 parts had to be in scale one with each other, the lever needed to be comfortable to manipulate and the screen with enough space to display and to let the user interact with it in a comfortable way.

Although is not binding, a check with the anthropometrics scales is useful to see if the dimensions are inside the range of the average dimensions, especially with the lever and the position of the machine in reference with the body.



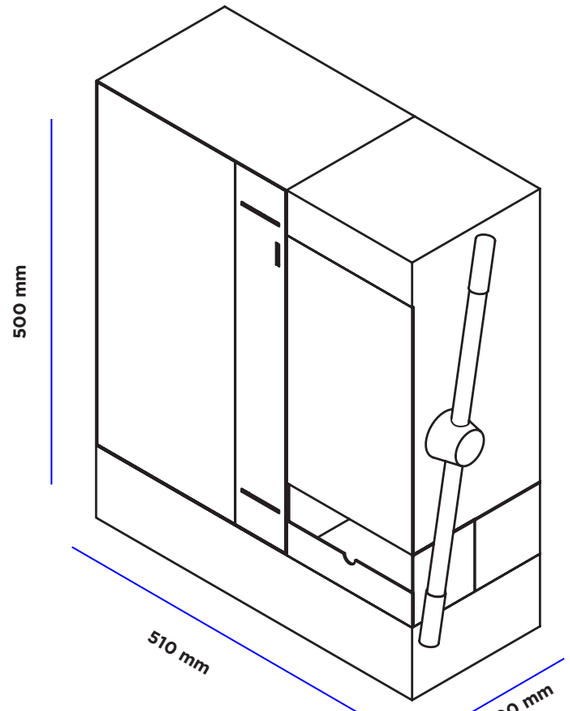
The machine usually will be hanging on the wall or supported by a special system to move it around.

Títol Esgotat



TÍTOL ESGOTAT
& STRUCTURE

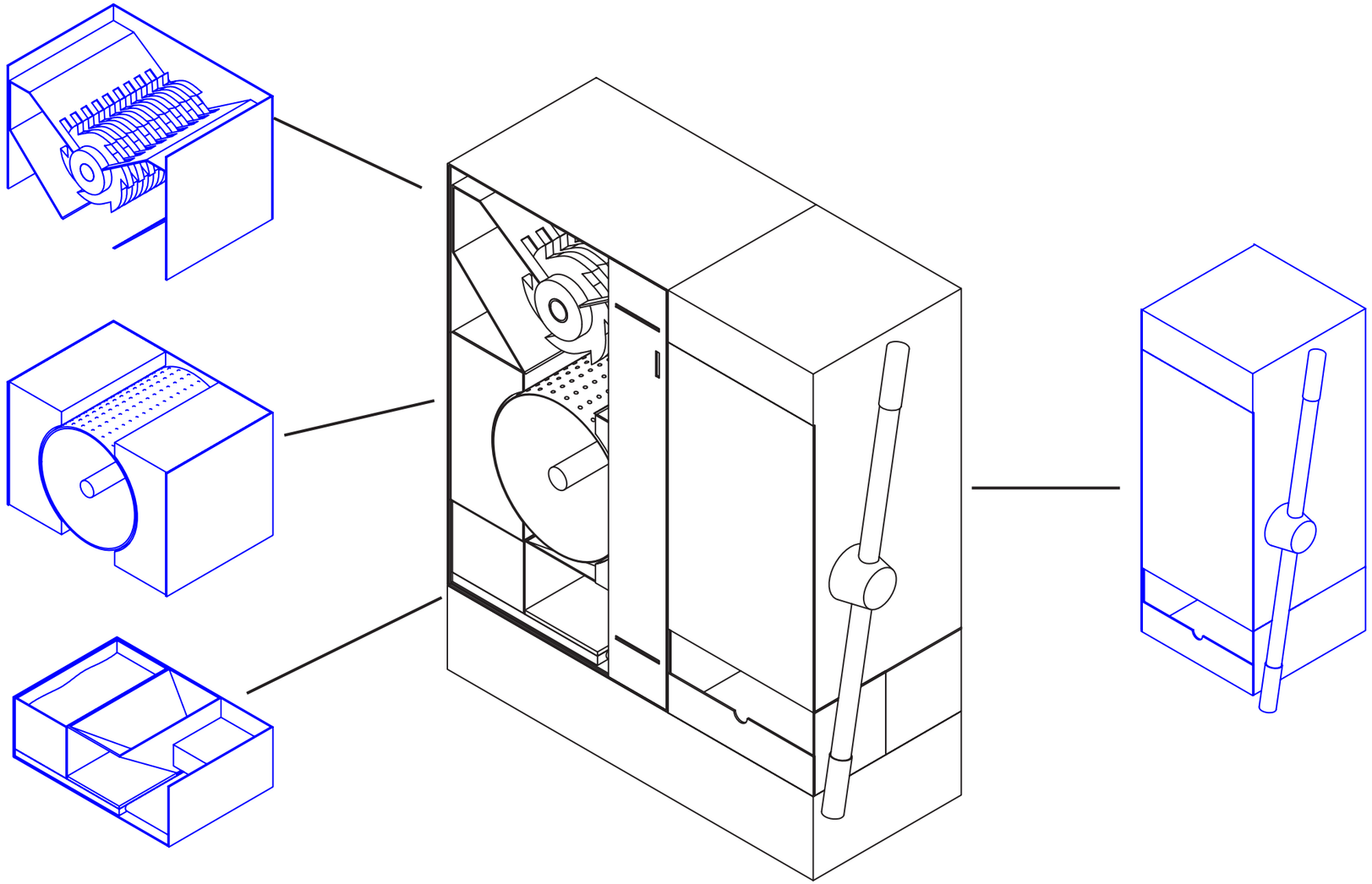
TÍTOL ESGOTAT



Títol Esgotat

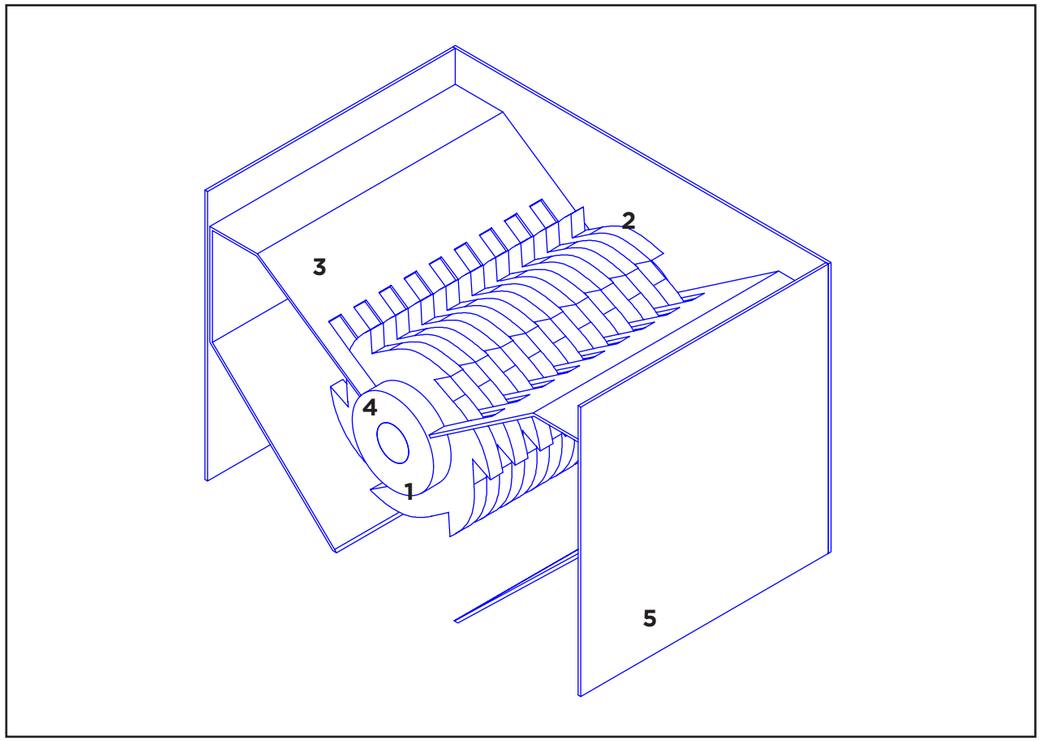
Títol Esgotat

MODULES & PARTS



Títol Esgotat

MODULE 1



Títol Esgotat

SCHREDDING

This component is composed by as system of blades with guides to cut into pieces the receipt paper.

The main materials are stainless steel sheet, alumiunium tube, and standard pieces such as the blades and the spacers.

1. Axis

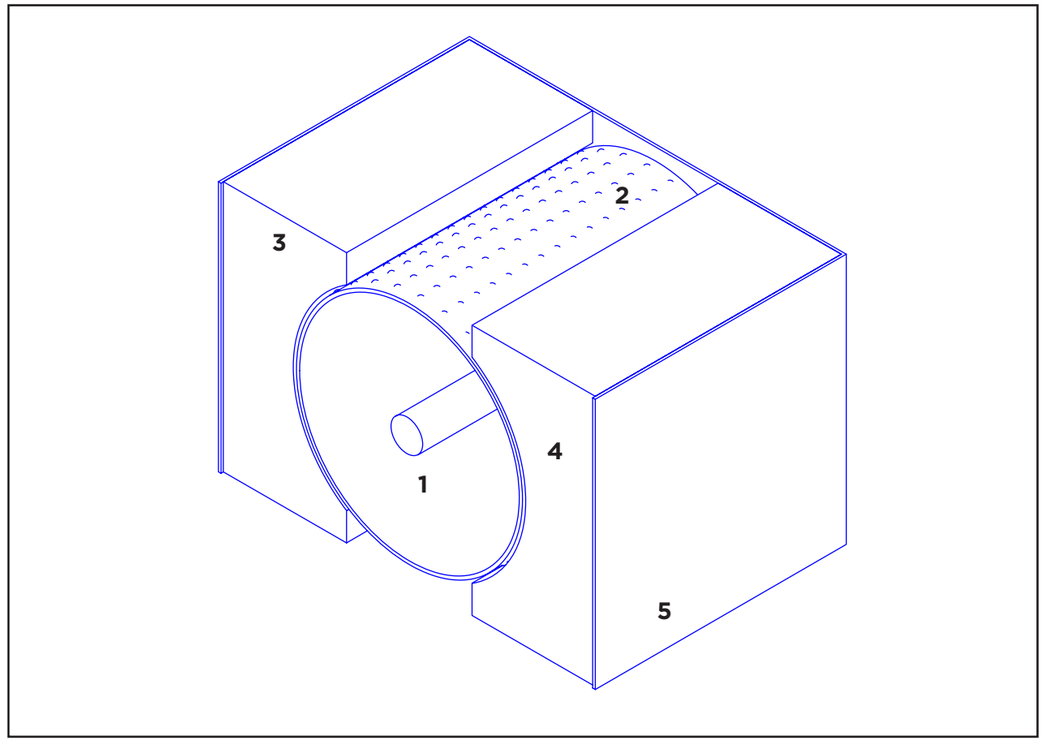
2. Blade

3. Guide

4. Spacers

5. Support

MODULE 2



Títol Esgotat

GRINDING

This part is in charge of defibrating the paper, by grinding the pieces between the drumb and the metal sheet, that has bumps on it.

With this process, called dry defibration the paper could be reshaped easily.
Taking advantage of the empty space, electronics and actuators will be placed on the sides.

1. Axis

2. Drum

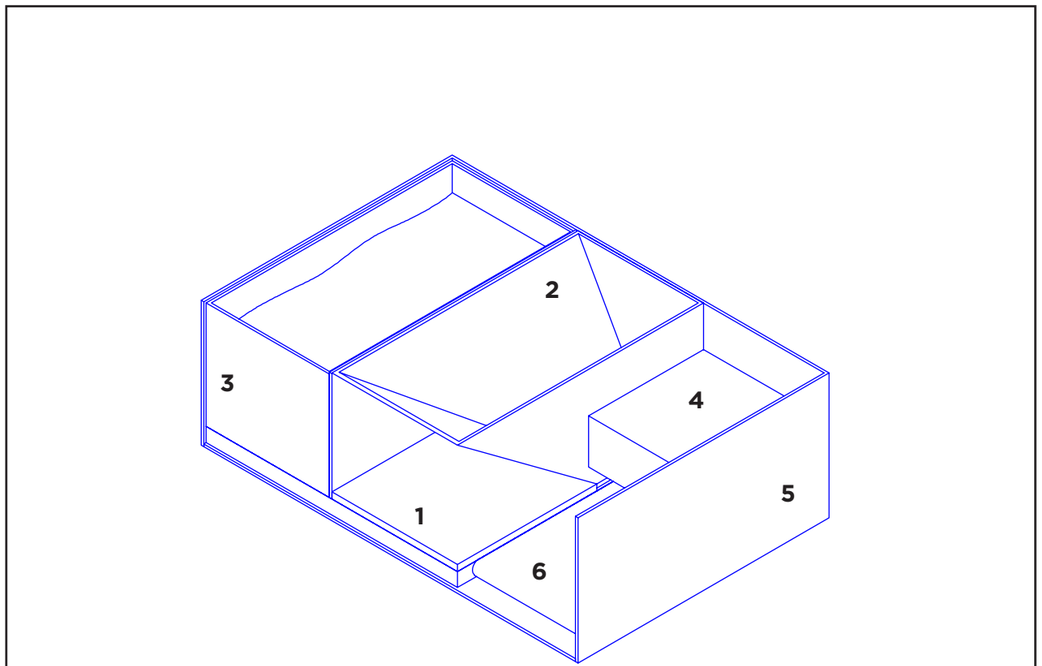
3. Grind Sheet

4. Electronics / Motor

5. Support

Títol Esgotat

MODULE 3



BINDING & PRESS

On this module, the paper fibers are kept to mix them with the binder.

After that they are diposited in a plate with the transportation ticket dimensions and compressed to fix the mixture.

Once the mixture is fully pressed the machine dispenses them.

1. Servo Motor

2. Funnel/Storage

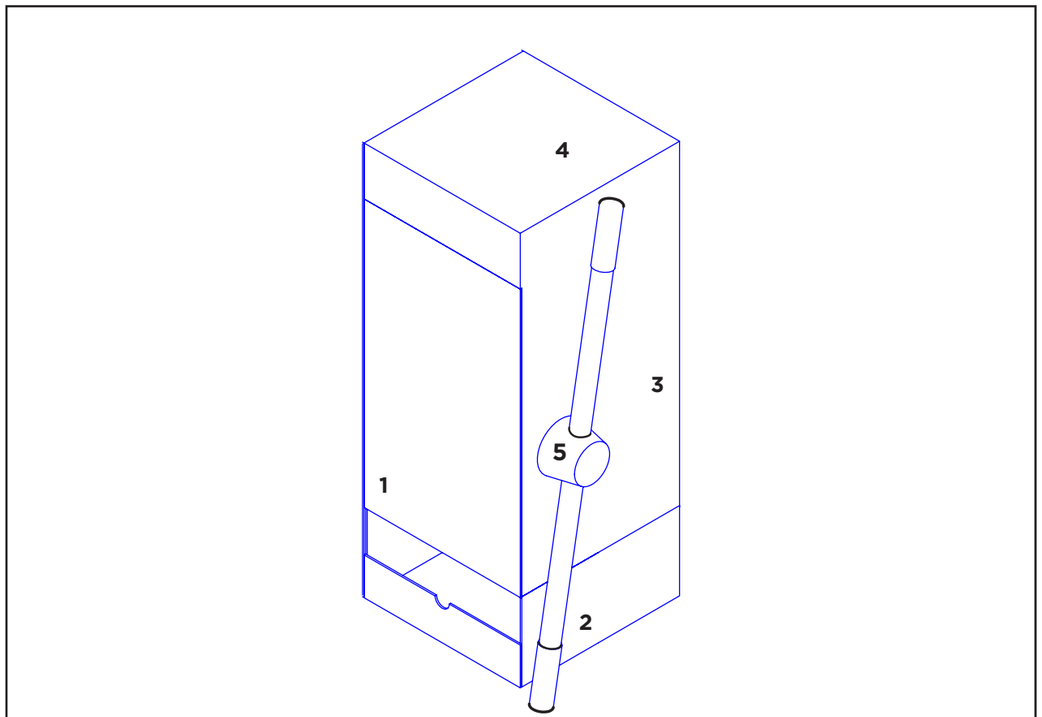
3. Binder Recipient

4. Press Mechanism

5. Support

6. Conveyor

PART 4



DISPLAY

The lateral part has two main functions:

The first one is supporting the display that gives information and knowledge to the users.

The second one is to provide a recipient where to place receipts the users doesn't want, and give them to others to process them.

1. Display

2. Compartment

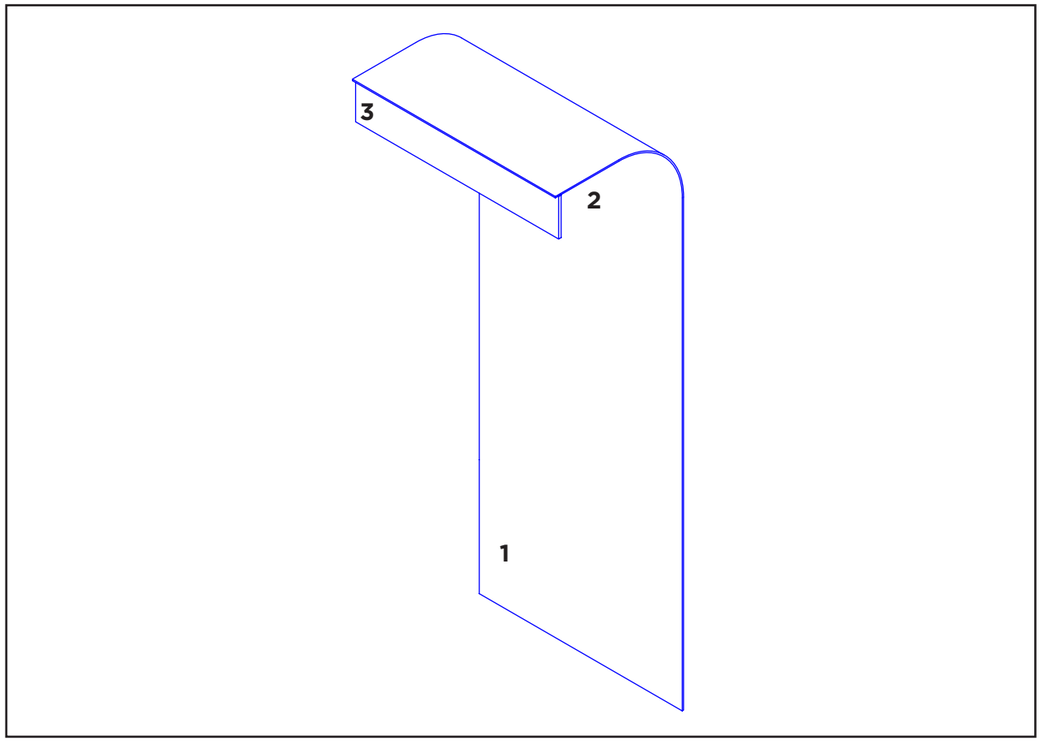
3. Electronics

4. Support

5. Lever

Títol Esgotat

PART 5



Títol Esgotat

SUPPORT STRUCTURE

The structure helps to redistribute the weight of the machine through more surface space. Also, the main function is to give more visibility to the machine, and inform the user, or potential user, where the machin is in a more graphic and clear.

The structure could be seen easily because its dimentions, materials and shape. Easy recognizable as the main characteristic.

1. Support

2. Light

3. Title

TÍTOL ESGOTAT

Títol Esgotat

Títol Esgotat


Títol Esgotat.
THE PROBLEM ISN'T THE MATERIAL
Tickets
Títol Esgotat.


Títol Esgotat.
THE PROBLEM ISN'T THE MATERIAL
Tickets
Títol Esgotat.

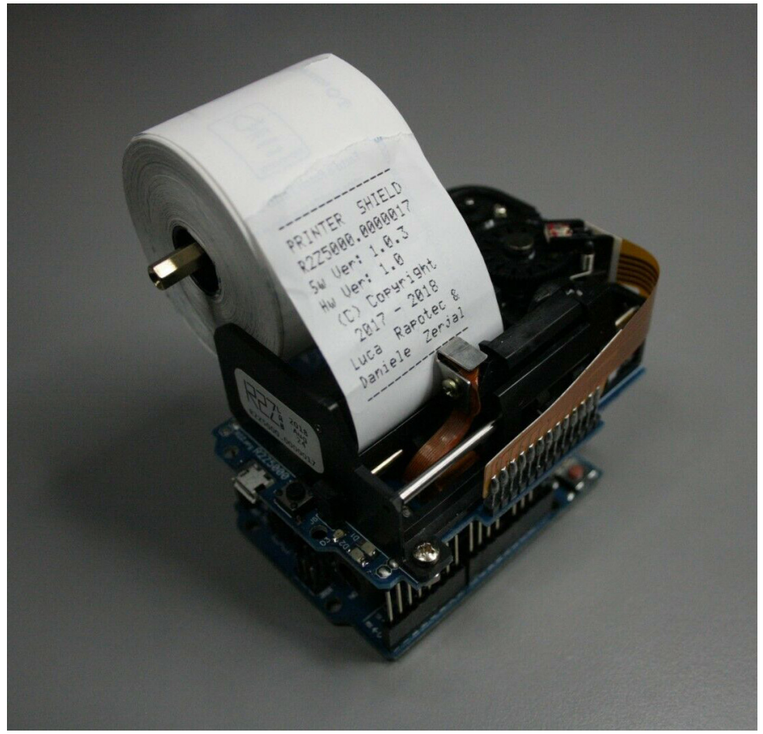
Títol Esgotat


coles
coles
DELIVERY TIMES
Títol Esgotat.
S.A.F.S
SPRINKLER
BOOSTER
CONNECTION
GROWERS,
JENNY &
PETER
Títol Esgotat.


U8 Wittenau
Hermannstraße U8
SOS
Titol Esgotat.
Titol Esgotat.

7 | INTERACTION

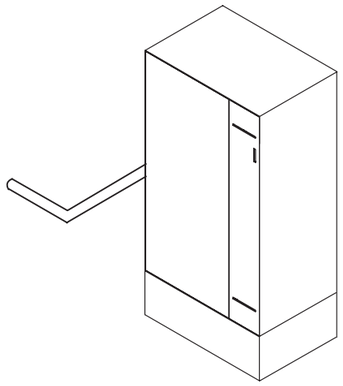
MANUAL VS AUTOMATIC



Raspberry PI Thermal Paper Printer Hat, Designed by R27. Could be found at Tindie.com

OPTIONS

MANUAL

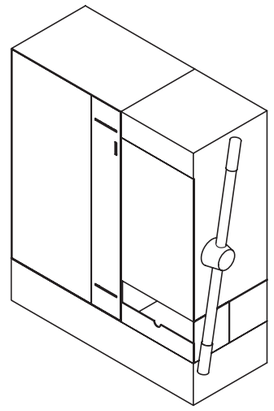


This version is activated by the user; with a lever and connecting gears, the rotation both from the schredder and from the grinder is generated by the movement of the user. It lacks the display, but the information will be shown on the supporting movable system.

It is a fully independent working system.

For exteriors | Interaction

AUTOMATIC



The other version is activated by the user also but automatically by the interface and the insertion of the receipt. It is meant to be in interiors with possibility of charge.

It is a more efficient version due to its constancy of quality on the result of the transportation ticket, also more accesible to anybody.

For interiors | Eficiency

USER GUIDE

There are two paths, one where the user treats the material and then has the option to purchase the ticket, and other where the user only wants to buy a transportation ticket if there are any available.

The first part directs the user through the whole circuit, whereas the second path redirects automatically to the step 6 pulling the lever.

STEP 1: Start

The first action the user do is to interact with the screen to start the process, summarized and short instructions of how to operate the machine will appear to let the user know how it works and what to do in the next steps. The machine itself explains how to proceed.

STEP 2: Introduce the receipts

Once the machine started, the user will introduce the receipts for its transformation into transportation tickets. First, the machine aims to collect and treat the material, when the treatment finishes the user will decide if he wants to pay for the ticket or only treat the material.

STEP 3: Pull Lever

To start processing the material, the lever has to be pulled. When this action is done, a fast rotatory effect appears on the screen passing through different headlines or information about waste treatment and stops in one at random. After few seconds (less than 10) the switching mirror panel becomes transparent and lets the user see how the process is done.

STEP 4: Watch the process

Once the lever is pulled, the mirror switches to transparent, letting the user see through it and watch the process of the transformation happening (like the modern coffee vending machines or other machines). In that way the viewer could understand in a small scale one way of treatments of the material and increase their positive perception of the value of the products as well.

STEP 5: Pull Lever

When the process finishes the machine indicates the user to pull the lever to pass to the final step. The result on the mirror is the opposite of the first pull, and the glass becomes mirror again. The display shows again another randomized rolling headline or piece of news and then changes to the final screen.

STEP 6: Pay

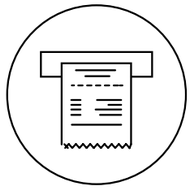
The final step is to pick up the ticket if wanted. Although you can choose not to. The first option is not to pay, the user don not get the ticket, but would have treated the receipts and the transportation ticket would be stored for other user to take. If the user wants the ticket in that moment, he will have it with an x% of discount.

USER GUIDE

TREAT & PURCHASE

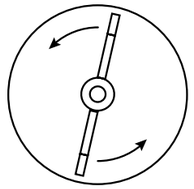
STEP 1

START



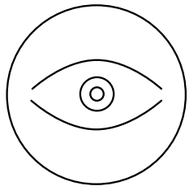
STEP 2

RECEIPT



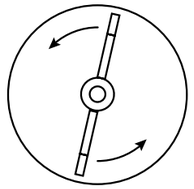
STEP 3

LEVER



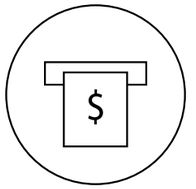
STEP 4

WATCH



STEP 5

LEVER



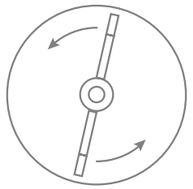
STEP 6

COLLECT

ONLY PURCHASE

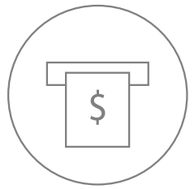
STEP 1

START



STEP 3

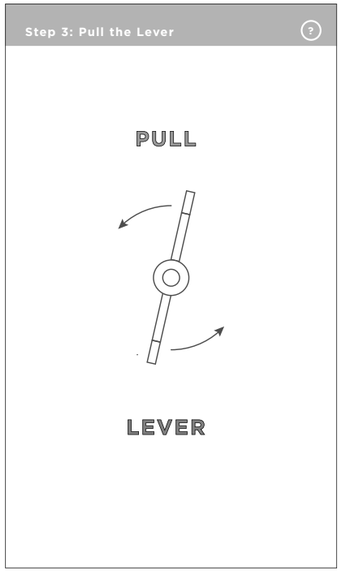
LEVER



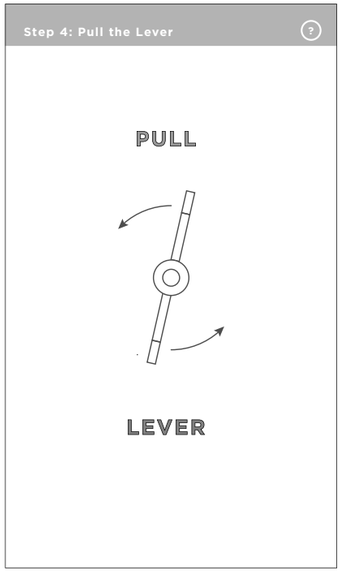
STEP 6

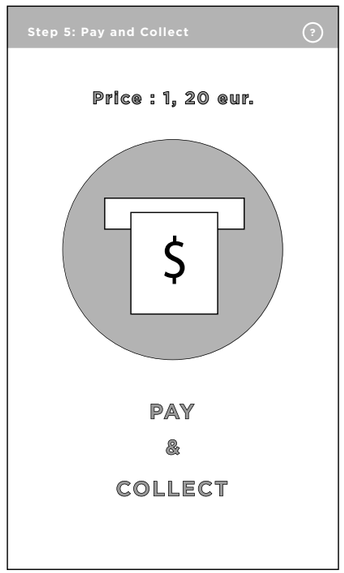
COLLECT

TYPES OF SCREENS



UN report by academics Roland Geyer, Jenna Jambeck and Kara Lavender, 2018.
Photo by Samuel Zeller on Unsplash





DIAGRAM

UN report by academics Roland Geyer, Jenna Jambeck and Kara Lavender, 2018.
Photo by Samuel Zeller on Unsplash

FACUA Reports 2015.
Photo by Alfonso Navarro on Unsplash

FACUA Reports 2015.
Photo by Alfonso Navarro on Unsplash

Random Permutations

Step 1: Start

TREAT

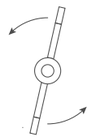
PURCHASE

Step 2: Introduce Receipt

INTRODUCE
RECEIPT

Step 3: Pull the Lever

PULL

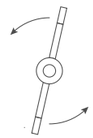


LEVER

UN report by academics Roland Geyer, Jenna Jambeck and Kara Lavender, 2018.
Photo by Samuel Zeller on Unsplash

Step 4: Pull the Lever

PULL

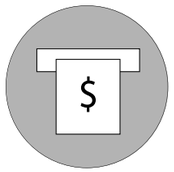


LEVER

FACUA Reports 2015.
Photo by Alfonso Navarro on Unsplash

Step 5: Pay and Collect

Price : 1, 20 eur.

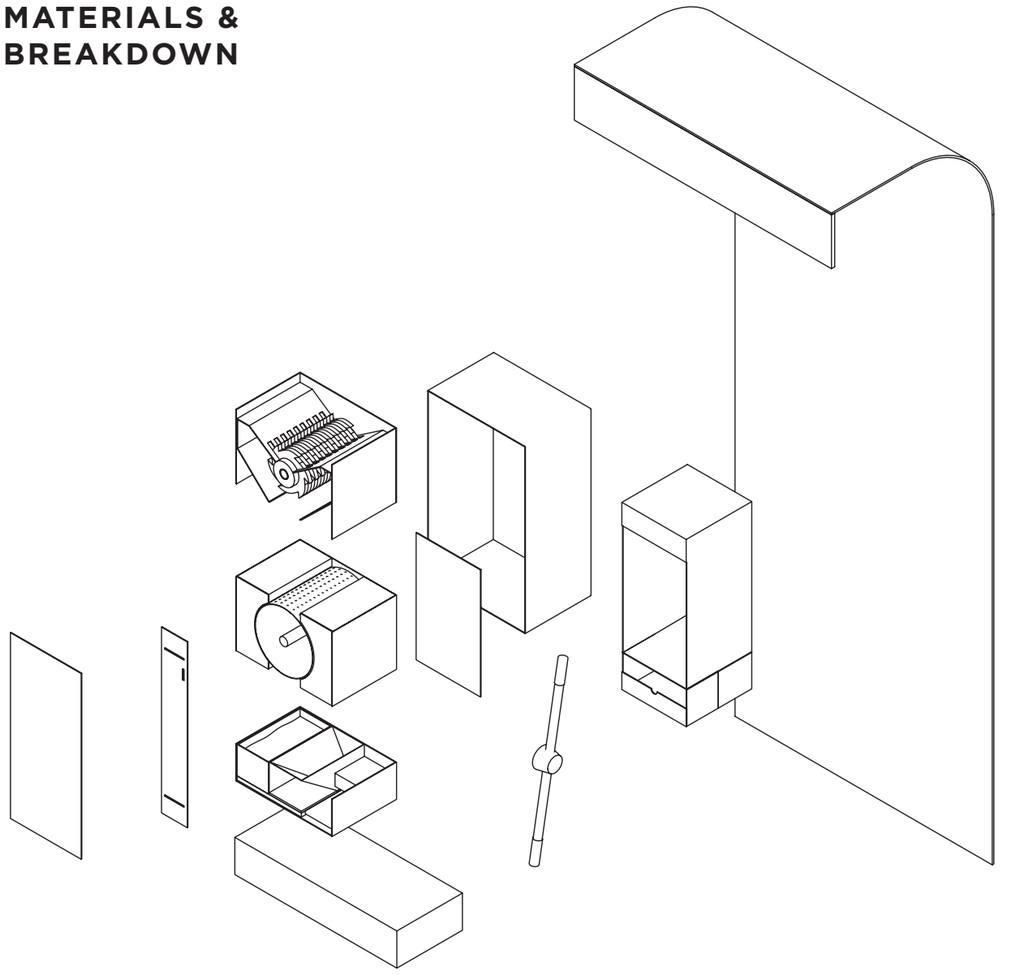


PAY
&
COLLECT

PULLING THE LEVER

8 | VIABILITY

MATERIALS & BREAKDOWN



MATERIALS

On this stage, the material selection will be explained. Pondering the needs of the elements with the availability, viability and sustainability of the materials is the selection criteria followed to choose these materials among others.

Grouping the parts in categories would help to seek the needs of each one of the groups in a more fluid way.

Structural:

The structural part needs to be resistant to deformations by forces, to oxidation or weather degradation, rigid and rough and with the possibility of different superficial treatments.

Functional:

The functional elements should be durable, resistant and optimal for their functional purpose.

Interaction:

The ones in charge of the interaction must let the user how they work helping the affordance, where to touch, where to look... In addition, they have to be resistant because they will be most touched ones.

Some specific requirements are:

Recyclability

If there is a material that is recyclable but that makes the price rise it will have preference over others since, above all in these products, it is important to design with ethics and generate the least possible impact.

Bulk resistant

The material the more resistant to buckling the better since few of the pieces, above all, work buckling, it is not an excessively high force, but this way stability is better assured.

Medium-Low price

The price will be if possible in a mid-range due to the quantity of machines and the accessibility they must present.

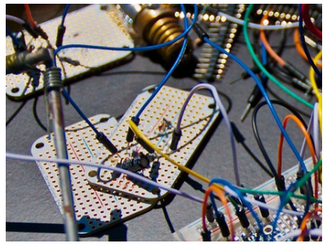
Fracture Toughness

The fracture Toughness is one of the most important characteristics for the outside and the structural internal parts of the machine.

GALVANIZED STEEL

Image by TextureX.com

ELECTRONICS



ALUMINIUM

Aluminum Tubes | Photo by Vessco Overseas

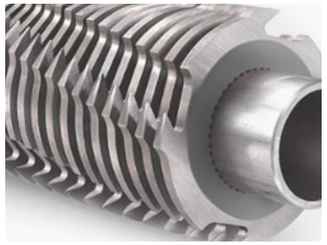
PAPER BINDER A-PLA01

Paperlab | Photo byVáclav Nývlt, Technet.cz

TRANSPARENCY SWITCHING MIRROR

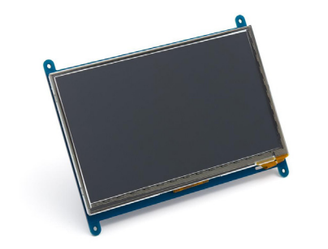
Photos KentOptronics, Switchable Mirror/Glass, 2019

BLADES



Paper shredder blades| Fellowes

DISPLAY



LCD HDMI Touch Screen Display by Little Bird

SCREWS

Index TA282C3932 - Tornillo rosca chapa DIN 7982 huella cuadrada

Viability

COMPONENTS BREAKDOWN

Components	N°	Material	Kg (unit)	Industrial Process	Recovered
Exterior Sheet	1	Galvanized Steel	1	Cut and Fold	90
Glass	1	Kent-o Switching Glass	1,3	Cut and Grind	100
Coin Counter & entry	1	Standard	0,6	/	100
Ticket Dispenser	1	Standard	0,076	/	100
BPA Filter	1	Standard	0,04	/	0
Ventilation	1	Standard	0,11	/	100
2 Module1: Shredder					
Shredders	9	SS	0,57	Machining	90
Spacers	10	SS	0,04	/	90
Guides	2	Galvanized Steel	0,04	Cut and Fold	100
Axis	1	Aluminium	0,08	Cut	100
Support Sheet	1	Galvanized Steel	0,75	Cut and Fold	100
3 Module 2: Grinder					
Cilinder Grinder	1	Steel	0,8	Cut, Stamp and Roll	90
Cilinder Grinder Big	1	Steel	0,02	Cut, Stamp and Roll	90
Axis	1	Aluminium	0,08	Cut	100
Cilinder-Axis Support	2	Aluminium	0,02	Cut	100
Support Chapa	1	Galvanized Steel	0,75	Cut and Fold	100
Compartments	2	Steel	0,5	Cut and Fold	100
Motor	1	Standard	0,2	/	100
Electronics	1	Standard	0,05	/	100
4 Module 3: Press					
Container	1	PET	0,02	/	100
Valve	1	ABS	0,001	/	100
Funnel	1	Galvanized Steel	0,3	Cut and Fold	100
Motor Guidance	1	Galvanized Steel	0,09	Cut and Fold	100
Platform	1	Galvanized Steel	0,03	Cut and Fold	100
Press Support	1	Galvanized Steel	0,08	Cut and Fold	100
Press	1	Standard	0,4	/	100
Transport Line	1	Standard	0,04	/	90
Gears	3	Standard	0,09	/	100
Support Sheet	1	ss	0,3	/	90
5 Module 4: Display					
Display	1	LCD Display	0,63	/	100
Protector	1	Glass	0,12	Cut and Grind	70
Support Sheet	1	Galvanized Steel	0,37	Cut and Fold	100
Electronics	1	Standard	0,007	/	100
Drawer Sheet	1	Galvanized Steel	0,08	Cut and Fold	90
6 Unions					
screw thread sheet	52	Standard		/	100
Nuts	52	Standard		/	100
Hinges	2	Standard		/	100
Lock	1	Standard		/	100

STRATEGIES

Disassembly

One of the strategies of Ecodesign that has been applied to make this machine is the disassembly of all its parts.

If it is facilitated that the user can be disassembled in an easier way after the useful life of the product, he can separate the parts by better materials and improve either their recyclability or their reuse in a more efficient way eliminating intermediate processes that have a cost energetic and high CO2 emissions.

Material Reduction

When using a single material for each part, the product is also environmentally improved since the materials of each part do not have to be separated apart from the parts themselves, with which the energy costs as well as the emissions are also reduced.

Material Selection

During the development process, the materials are selected.

On that step, some requirements are generated that limit material properties to adjust the most appropriate materials to the needs of the product.

It is crucial to put the requirement that these materials should have little environmental impact when they are processed or that are recyclable in an easy way, or usable or that have a life cycle as extensive as possible.

All this aspects should be applied without forgetting the requirements that mark the project, since it also has to be a safe and meet some standards of performing, etc.

Reuse

Once the end of the useful life of the product arrives, the most appropriate treatment process that minimizes the environmental impact the most is the reuse process; either the reuse of the product itself or of the pieces that form it, either for another equal product or for a different one. In that way new pieces are not processed or re-processed, they are used as soon as the machine is disassembled if desired.

Having standardized components is useful in the way of applying them to other products. Unfortunately, some of the pieces have been made to fit this project and the reuse process would not be so direct, but the pieces could be used in some other project.

Repairability

Reparability is a strategy that is closely linked to that of disassembly. This strategy is that if one of the pieces or some component fails, design the product so that it is easily repairable or replaceable and thus fix the machine.

In this way, instead of every time making a new one or having to change a whole set of pieces, only that which is necessary is replaced, extending the useful life of the product and minimizing the impact when manufacturing new parts.

In this case how all the parts can be separated from each other and many are standard can be repaired very easily if it suffers some damage and with easily replaceable and accessible components.

Multifunctionality

This project is already based on multifunctionality to have a part of awareness and criticism besides another functional.

Having this multifunctionality avoids needing or acquiring different products that cover the same need or provide the same value and, if the product complies with the rest of the strategies, it is equivalent to acquiring two products, minimizing the environmental impact and eliminating redundant products.

Viability

LIFE CYCLE ANALISIS

In this phase, the life cycle and the environmental analysis of the product will be analysed both in the usage phase of the machine and in the treatments that are carried out at the end of life of the product.

First of all, each part of the product is structured, the quantity of units of each one of the parts, the material that conforms the components, the industrial process, if the pieces have any surface treatment. In addition, it has to be specified the percentage of recovered material once the useful life is finished and how it is processed when it reaches the end of the usage phase.

From this point and through the CES Selector program, which incorporates a section of environmental analysis and life cycle called Eco Audit, an analysis of the energy consumption and CO_2 emissions that each phase of the life cycle involves for each piece is conducted.

Taking into account how the material is extracted, how it is processed to make the piece, the transport of the product or parts, consumption and emissions during use in the time of life indicated. In addition, it analyses parameters when the usage phase of the life cycle ends, parameters such: the necessary processes to disassemble the parts once the useful life ends and, finally, if it has a final treatment such as Recycling or Reuse the program takes into account the quantity of energy and emissions that will be saved in the next production.

In this particular project, the machine itself is analysed, the entire life cycle to visualize the points of improvement of eco-design and to be able to make redesign decisions if necessary.

Three different considerations and scenarios are applied in this case: The painting and surface treatment of the machine and the type of energy consumption during the usage of the machine.

Besides, a comparison between the process of the machine and the current industrial process most used for treating the receipts, the landfill is analysed.

LIFECYCLE

● Start

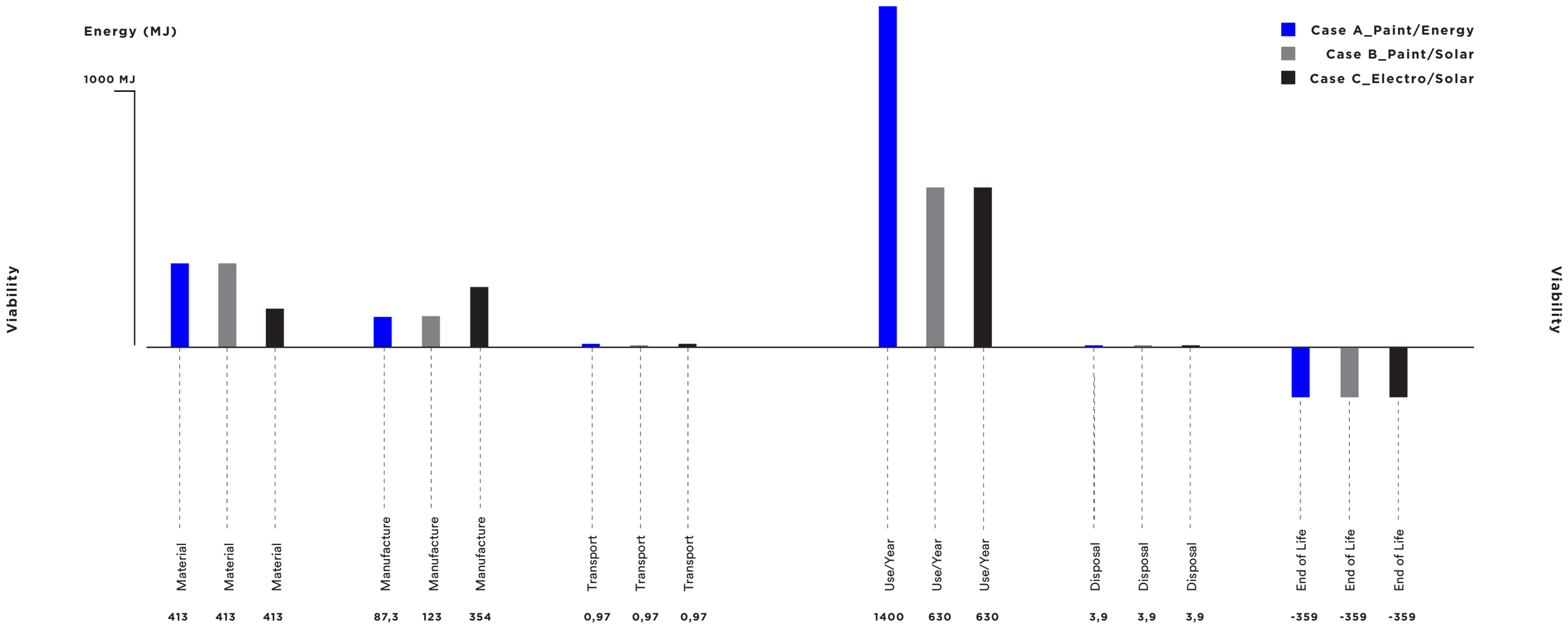
■ End

○ Repeat

●○ 1. Product design
2. Obtaining raw materials
3. Industrial process
4. Packaging
5. Transport product
6. Distribution to points of sale
7. Product sales
8. Product installation
9. Use by consumers
10. Waste
11a. Product recycling

■ 11b. Waste (non-recycled)

CASES COMPARATION



CASES COMPARISON ANALYSIS

Once the results are visually represented in the charts and the numbers contrasted, it is safe to say that the it is better if the painting is not with an electrical method and the energy, if it is able to choose, select the solar source when possible.

The case with less environmental impact is the Case B: Painting/Solar. Having this information an specific analysis on that case will be driven to know if it is needed, where and how any process of the life cycle could be improved or environmentally optimized.

Photo by Samuel Zeller on Unsplash | Example of painted metal finish

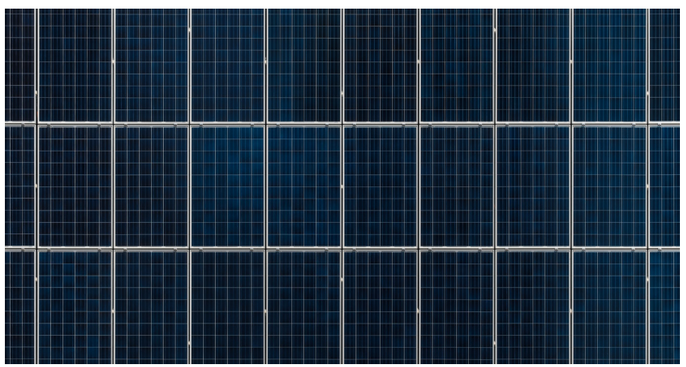
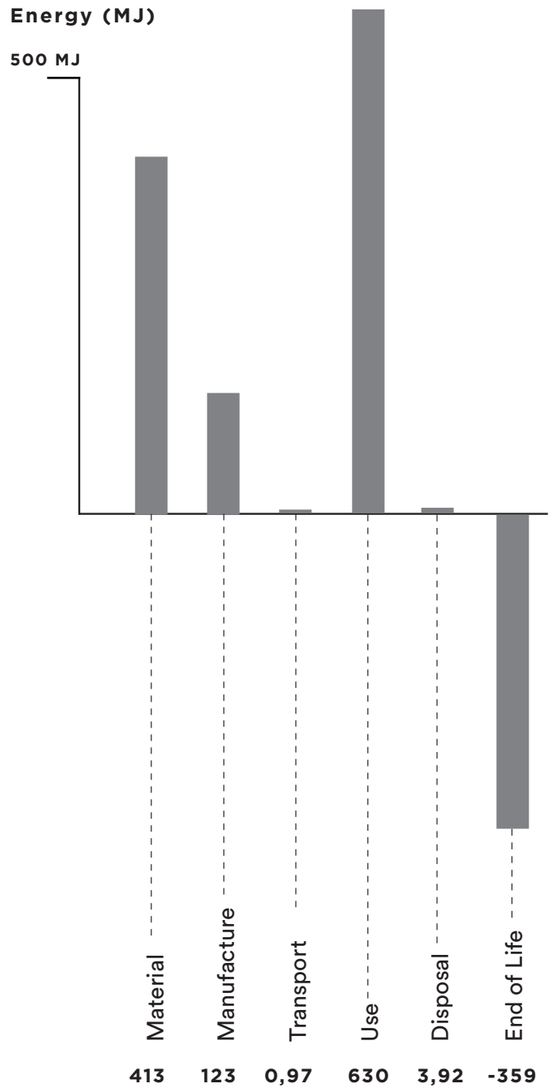
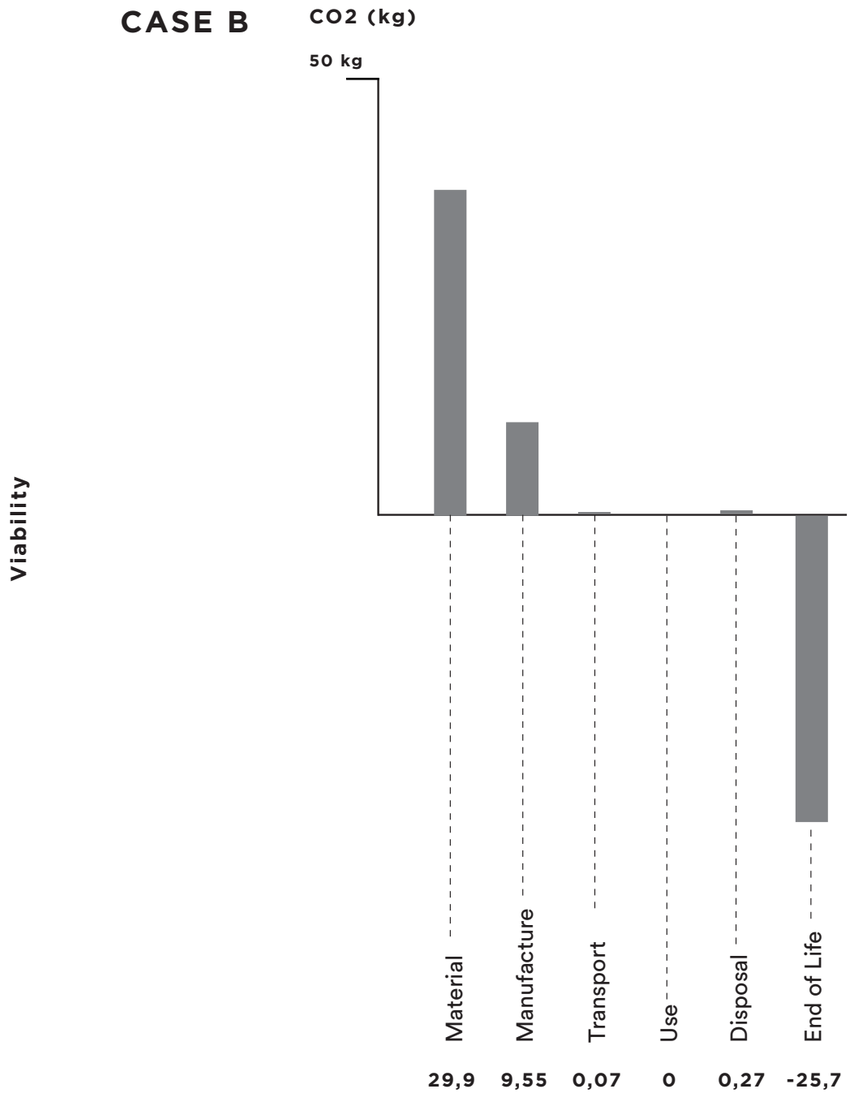


Photo by Samuel Zeller on Unsplash | Blue Solar Panell

CASE B



CASE B



CASE B ANALYSIS

Analyse the he graphics on the Case B would be useful to detect the critical points of the design and search for improvements or modifications if it is possible and needed.

The Energy of each one of the phases and the Co2 expelled are relevant characteristics to discern if where to improve the design process and if the changes depend on the first level of influence or if it has to be decided in other areas.

On one hand, the critical point in this case regarding the Energy consumption is the Use phase which has the 95,9% of the total consumption, this happens because it is on and running almost all days of the year and almost all day, the source of the energy also, depends on the company that supplies the energy.

The second main point on the energy topic is the extraction of the Material. Digging deeper, the steel parts are ones that requires most of the energy but in this case makes sense because the mass of that material is bigger than the other materials. Although compared with the Use is almost nothing. The Bench Marking and the requirements of the materials pointed the steel as the main material of usage and in the EoL (End of Life); restoring energy phase is the one that has the impact that is more positive.

On the other hand, the Co2 production, the peak of the production is the extraction of the Materials.

It could be seen that, as well as happens on the energy needed for extracting the materials, the ones that requires more are the steel parts but, as well as in that case, they are the most beneficious in the EoL phase.Besides the steel, the second material which its productions produce more Co2 kg is the paint.

With this information, a different paint or method of painting could be applied to reduce that emission of Co2.

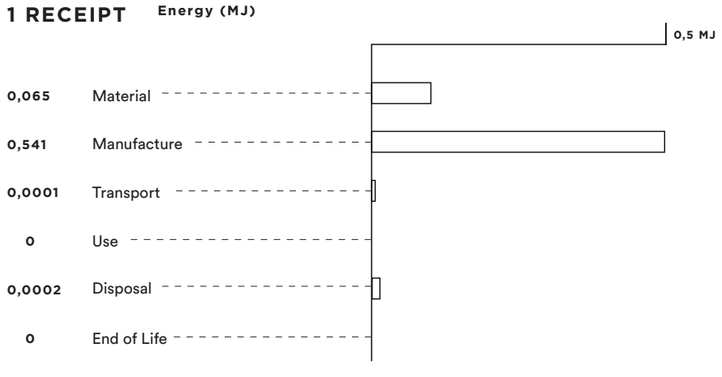
PROCESS COMPARISON

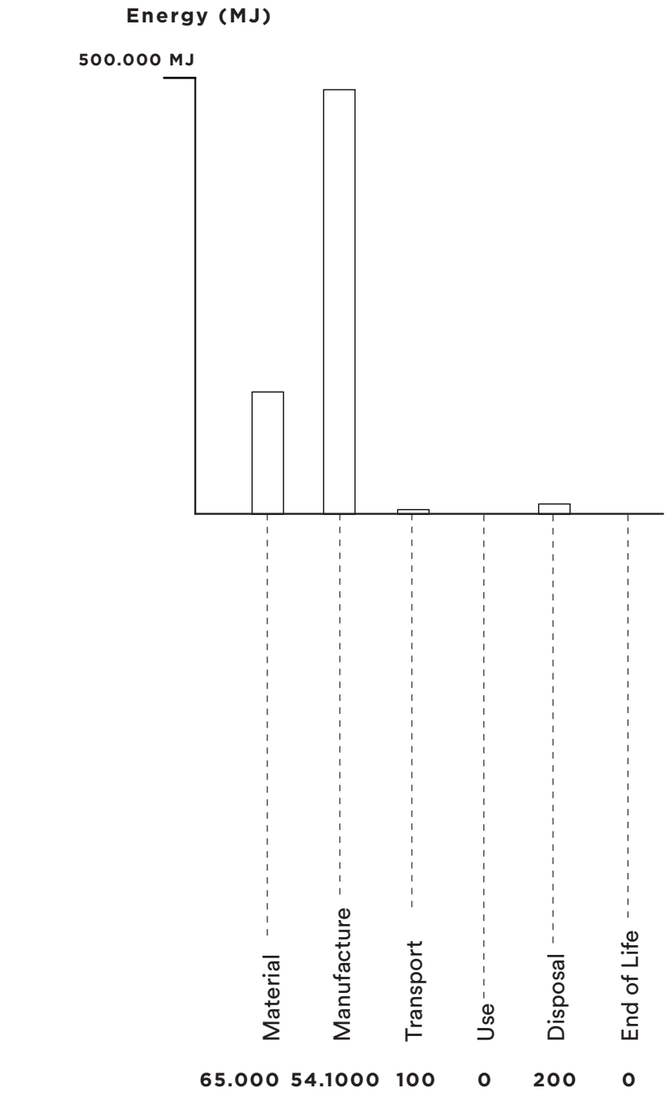
Once the path of usage of the machine is stablished, a comparison between the actual process of treating the receipts and the one of the life cycle of the machine could be useful to determinate if this machine is optimized.

As explained at the beginning of the project the process of treatment of the receipts most stablished nowadays is to carry them to the Landfill.

The data for this process has been extracted considering the life cycle of one receipt only, but for a comprehensive comparison, the data should be multiplied in a way that the numbers of receipts compared equals the number of receipts treated by the machine in its life cycle.

For this analysis a quantity of 10^6 receipts will be compared with the machine. The machine will process more than that many receipts but in this case with that data will be enough to extrapolate the result and stablish some conclusions.





MARKET OPORTUNITY

Doing research into the context of usage of the machine we find several large market niches, such as public community spaces like supermarkets, the TMB company of Barcelona and other organizations as Ateneus de Fabricació or other entities related to the awareness about sustainability... Who would be interested in acquiring and / or using this product, for creative, useful or educational purposes .

By making estimated calculations it will be assumed that the first year, the influence of the machine will reach 5% of the market, acting locally and not having a strong place in the market, there would be still 300 centers/spots that could be interested in the product.

(Some of the prices and costs are the standards or comparatives, because from some of the parts there are no avaliable information)

COST OF THE PHASES

Development | **Manufacturing** | **Delivery**

COST OF THE PHASES

Development | Manufacturing | Delivery

1.DEVELOPMENT

In this phase we will consider all the costs related to the conceptualization of the projects, like our potential salary, the cost of the space we may work in, the tools we use to make the research and evolve the idea or the time we spent thinking and increasing the project value.

Salary (in BCN) aprox. 3379eur. = 21 eur./hour

Software

Adobe CC (license)	4500 eur.
Network	1200 eur.
MaxRendering (licence)	10000 eur.

3,7 eur./hour

Hardware

Computer & setup	2100 eur.
Printer	875 eur.

Furniture
(Chair, Desk, Lamp) 600 eur.

0, 6 eur./hour

COST OF
THE PHASES

Development I Manufacturing I Delivery

Marketing
(Meetings, Benchmarking, Competitors studies, ...) 350 eur.

2,15 eur./hour

Office space

50 m2/3persones 30 eur./person/month

0,25 eur./hour

Water, Gas, Electricity, Internet conexion... 0,5 eur./hour

28,20 eur./hour

+ 15%

32,47 eur./hour (minimum) x +/- 300 hours

Total
Development Cost

9729, 1 eur. (minimum)

COST OF
THE PHASES

Development I Manufacturing I Delivery

2.MANUFACTURING

The costs of this phase consist on all the machines, the space, the workers, the materials and all the factory related issues tha are inside the product manufacturing.

Parts 121, 37 eur./ unit

Machines & tooling

Pipe cutter 8000 eur. *

Sheet folding machine 14000 eur. (An standard one)

22000 eur. /300 units
(price minimum for the first run)

Factory 700 eur./month = 175 eur./first run

Workers 40 eur./hour = 4800 eur./first run

Insurances//Maintenance 1500 eur./month = 375 eur./first run

Garbage // Recycling 400 eur./month = 100 eur./first run

27450 eur. /300units (without parts) = 91,5 eur./unit (+/-)

+121,37 eur./unit (+/-) parts

Only the manufacturing process
Regular accuracy 212, 87 eur./unit (+/-)

Viability

Parts & raw material

Steel Sheet	3,97 eur./m2	(+/- 5,6 m2)
Schredder Blades	2-8 eur./unit	(9 units)
Display	29,62 eur.	
Glass (Switch)	16 eur./m2	(0,6 m2)
Electronics	12,7 eur.	
Payment mechanisms	10 eur. (standard ones)	
Dispenser	4.2 eur.	
Transport line	6,2 eur.	
Axis	2,96 eur. /m	(1 m)
Container	3, 79 eur.	
Unions	3,67 eur.	

121, 37 eur.

3.DELIVERY

In the delivery stage the cost of shipping the parts or the assembled products are considered.

The taxes, depending on the place, vary in a major or minnor values.

Inside Spain	3 eur./unit
Europe	3-7 eur./unit (depending on the country)
Rest of the World	12 eur. / unit

Once the cost analysis is completed, improvements could be suggested, such changing one of the most expensive parts, the Display, and picking another one from another provider, as well as the metal sheet. Another option would be planning a cost reduction by doing a little serialization with the manufacturers when the influence of the machine reaches more places.

LEAN CANVAS

key partners

Town Hall

TMB

AMB

Ateneus de Barcelona

Supermarkets

key activities

Analyse data and Improve Digital content.

Marketing.

Logistics with suppliers.

Infrastructure of Digital content.

Research in Technologies about treatments.

Maintenance.

key resources

Product:

-Production

-Assembly

Online:

-Architectural

value proposition

A system of machines to treat un-recyclable materials with the actual methods as well as rising conciousness and critical thinking among the users.

customer relatioships

Community (Digital interaction)

Ask for feedback

Technical Service

channels

Website

Digital Store

Ads

Social Media

Supermarkets

customer segments

Two main segments:

-Common Users

-Professional Users

cost structure

Production	Marketing Campains
Assembly	Employees
Distribution	Maintenance
Materials	Digital Maintenance

revenue streams

Regular Product

Expended tickets

Subventions

Advertising on the webpage

Refillables

Viability

Viability

9 | CONCLUSIONS

FINAL RELEXION

To conclude, I would say that with help of design and systems like the one designed in this project, a different approach to the recycling or treating of ‘waste’ methods could be useful. Having in mind this idea among all the design process of any project could provide profit in all the aspects: enviromental, economical, social ... .

With all of that being said, I think that this system of treating un-recyclable material by non-convencional methods, could be applyied to other kind of products in the same or similar point of view in a more local context, improving at some level how we see matter once it is used.

An additional key point would be to change the relation between design, industry and the user to try to improve the designs in every aspect.

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